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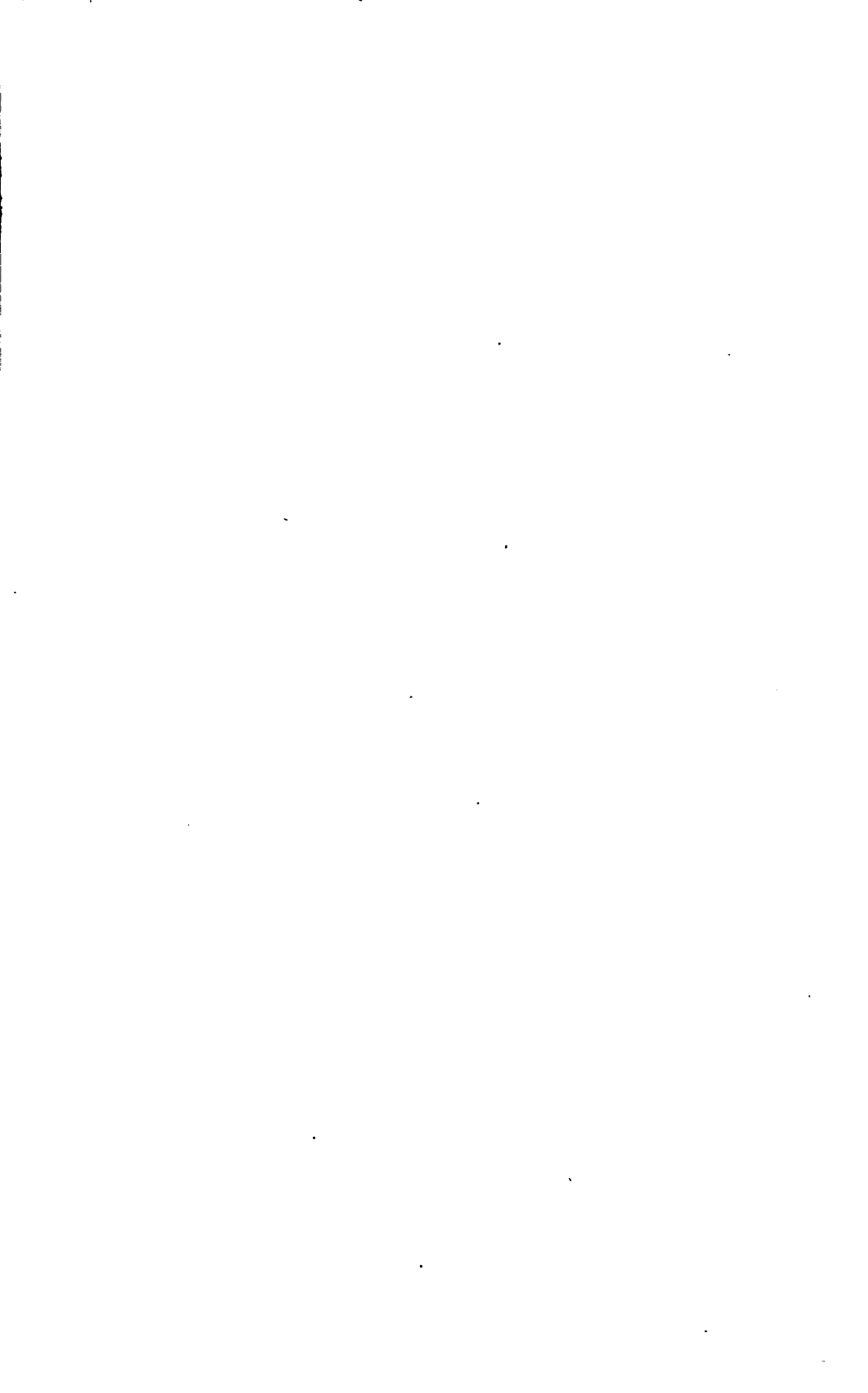
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PUBLIC HEALTH

PAPERS AND REPORTS

VOLUME XXXI

PART I

PRESENTED AT THE THIRTY-THIRD ANNUAL MEETING OF THE

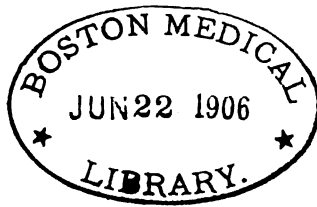
American Public Health Association

BOSTON, MASSACHUSETTS

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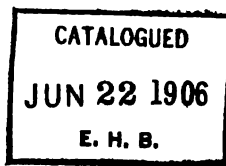


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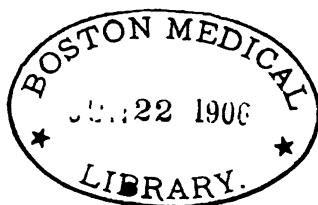
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CO-ORDINATED SPECIALISM IN PUBLIC HEALTH WORK.*

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In America two causes are operative in rendering it difficult to protect the health of the public. One is the lack of real knowledge on the part of the public in regard to the scientific truths which underlie the conservation of its chiefest asset, viz., its health, and the other is a tendency in the preservation of individual freedom to lose sight of our obligation to respect the rights and privileges of others who may be less assertive.

It is probable that each of these factors may operate as the cause of the other and it is difficult to discuss one without encountering complications dependent upon the other. Endorsement of public health protective measures in a general way by an individual has usually the mental reservation that they be so applied as to safeguard him against his neighbor, but not in such manner as to impose hardship upon him for his neighbor's benefit. The spread of accurate knowledge and the universal application of the "golden rule" are both to be advocated as necessary to secure permanency in the support by the public of the provision and enforcement of logical regulations which is at present only to be had under the stress of great fear and is then but temporary and spasmodic. Individuals and families are willing to submit to nearly any course of treatment or to any strictures imposed when the fear of sickness or death suddenly confronts them, but very quickly adjust themselves to conditions if they are prolonged and when the strain is removed forget the lesson learned and the promises made. The public acts in the same way and is willing to submit to discipline only when the necessity for it is plainly demonstrated by epidemics with high mortality or in the face of striking disaster. If such times could be utilized for the formulation and passage of logical regulations and the public could be induced to stand up for the continuous administration of such measures, *i. e.*, to take the same interest in the protection of its health as of its wealth or honor, progress would be rapid. It becomes necessary to convince the public, therefore, firstly that health is its most

important possession, secondly that it can be conserved and improved just as accurately and certainly as any other asset, and thirdly that preventive medicine is immensely cheaper and more efficient than curative procedures.

In countries like those represented in our Association, where the right of the individual is the primary consideration, there is a particular prejudice against the assumption of special or expert knowledge on the part of individuals or groups of people and yet it is necessary in the government of people by themselves that there should be specialization so that responsibility may be wisely placed and the greatest good to the greatest number ensured. There is nothing, however, in which individual right to opinion is so rigorously asserted as in the matter of health and through the medium of the press and in daily converse all kinds of peculiar and often pernicious views are voiced. The semi-mysterious seems to be attractive rather than the logical and those who are really interested in private welfare and public health are often tempted to long for a temporary monarchical form of government or military dictatorship if thereby the suppression of baneful theories of the cause, prevention and cure of disease and the advertisement of doubtful and dishonest remedies could be secured by edict. This is of course impractical, but in lieu of it the appointment of competent boards nominated by the leading national or international scientific, medical, public health and engineering societies, so as to permit of the preparation and censorship of technical material in popular form for distribution through the associated press and government bulletins, would result in the gradual education of the public. The substitution of real scientific truths, given in simple language so that children might readily understand, for the so-called "physiology and hygiene" now provided by some localities as text-books, would prepare our coming citizens to understand and protect themselves. Were such a comprehensive system feasible in the countries represented by our Association, the question of the education of the public and of securing enthusiastic support for public health legislation and its administration would probably be solved.

The total burden of responsibility should not be placed upon physicians as it frequently is. Their eager support of measures intended to safeguard humanity is usually misunderstood and misjudged because their honesty of purpose is questioned when they endorse methods, which, if logically carried out, will diminish their financial resources. As a physician not engaged in active practice, I wish to pay a tribute to the practicing members of the profession by asserting without fear of successful contradiction, that they have no superiors in unselfish devotion

to their fellow-man often in the face of a total lack of appreciation and too frequently in the face of suspicion or active opposition.

The practicing members of the medical profession who stand highest in their particular lines are the most enthusiastic, honest and earnest supporters of public health protective measures and urge most strongly the necessity of special qualifications and the broadest and most thorough training for those who are to be made responsible for their intelligent administration. They are the first to realize that their own training and experience, being largely in the direction of curing rather than preventing disease, must be supplemented by all the other allied sciences and that public health work has become a profession or a specialty which involves the necessity of a knowledge not to be obtained until in very recent years in the medical colleges, universities, engineering and technical schools.

A glance at the programme for this meeting will give some idea of the complicated mechanism and careful training in varied lines which are required in the care of the health of the public and their necessity should be recognized and demanded by the public. This most important matter should not be left, as it often is, in the hands of those whose knowledge and ability is along political rather than sanitary lines. Sanitarians have been far too little appreciated, not only by the general public but by the medical profession. The general public is inclined to regard a public health office of any kind as a "political plum." Years of experience, each one of which adds to the knowledge and value of any official, are apt to count for naught. The medical profession, on the other hand, has been apt to look upon a physician who is willing to undertake work of a particularly arduous character which essentially differs from and precludes him from general practice and yields little financial return, as lacking in ambition, independence or foresight. Such posts have been, therefore, unattractive, since the remuneration is usually small and the loss of medical practice and prestige is apt to be as certain as the tenure of office is uncertain. Reform in this direction is growing. Universities are preparing to co-operate with boards of health in providing special training. The time is now ripe when the public should demand that those entrusted with the care of its health should have special training and higher remuneration.

It is absolutely necessary to place such work upon a sure and firm foundation. The value of experience already gleaned should be recognized and every community should try to retain the services of individuals who have shown their ability and faithfulness in the various branches of public health as well as other public work. The city in

which we meet has set a most excellent example in this respect and she is to be congratulated on her appreciation of the initial ability, integrity and wide experience of the chairman of her board of health, who has devoted his life to the welfare of Boston for over thirty years and has been a leader in our Association almost since its organization and was once our president. We of Minnesota have piratically annexed the Director of the Boston City Board of Health laboratory and are still unrepentant, being selfish enough to want the best.

The older method of securing experience by experimentation on the public should be superseded by requiring preliminary special training at universities and by boards of health so that, whilst retaining for the good of the public, the service of those already trained and competent, they may be reinforced and when necessary succeeded by those who have received such special training. Undoubtedly, the public should demand the possession of special qualifications in both the executive and the other technical branches of public health service. Elective and appointive positions should be filled by those who have received special training and have, as evidence of their special qualifications, degrees or diplomas granted by competent authorities, as in Great Britain, where a diploma of public health is demanded of all medical health officers. Bacteriologists, chemists, engineers and other technical men should have special training in public health work before the responsibilities of public service are entrusted to them. Our programme provides for a consideration of this matter.

A knowledge of the clinical manifestations of disease is imperative, but often much more than clinical experience and ability is essential. Whilst in scarlet fever, smallpox and certain of the infectious diseases, it is nearly always possible to disagnosticate the condition present and by so doing to protect others from infection, there are a number of diseases in which clinical observation alone proves utterly insufficient. As illustrating this, diphtheria may be mentioned. It is the presence of the diphtheria bacillus which constitutes the danger of infection. Preventive measures should be and are demanded when this bacillus is present. Bacteriological methods have very greatly shortened the necessary isolation period. In diphtheria it is impossible to base the necessity for protective measures upon the local condition of the throat or the general or constitutional manifestations of disease. For this work and many other branches also, competent bacteriological advice must be at hand. It is not the typical cases which cause serious trouble to the sanitarian, but rather those in which the diagnosis is unsuspected or obscure. In many conditions, the laboratory is able to afford most valuable aid. Our programme includes a description of the laboratory

method of diagnosing smallpox which has doubtless been evolved in the further pursuance of the classical researches of Councilman and his associates. The dread of cholera has to some extent disappeared by a better understanding of its cause and means of transmission. Here again bacteriological methods are used almost entirely for diagnosis and the only preventive therapeutic interference which has been utilized is that of Haffkine, whereby cultures of bacteria are used for inoculation in order to induce immunity. The wonderful revolution in protective methods against yellow fever is well known to all. The work of Reed, who was vice-president of our Association at the time of his death, can be credited already with the saving of thousands of lives and the commercial benefits which have accrued to the American continent can scarcely be estimated since a prolonged period of quarantine and universal disinfection have been shown to be unnecessary and illogical. It is unfortunate that the wonderful efficiency and co-ordination of the methods employed by the United States Army in Cuba could not have been fully utilized in the present epidemic, but we Americans do not like discipline and as a result of a division of responsibility and lack of far-reaching supreme authority in the beginning, the ignorance and fear of the masses have lost our country many lives and we are deprived of the benefit and pleasure of meeting here our valued colleagues from the south, who dared not jeopardize the safety of their communities by such a remission of their vigilance as attendance at our annual meeting would entail.

The startling results claimed for Japan in protecting her soldiers against disease in the field do not appear to be so much dependent upon superiority in scientific methods as upon a clock-like discipline and patient far-sighted attention to detail. In the Japanese army the authorities seem to respect sanitary knowledge and to be willing and anxious to place responsibility upon the sanitarians and medical officers who are left supreme in their own domain. A similar policy with careful selection and adequate recognition of the sanitary officials would be found to be well worthy of emulation in Panama. It is to be regretted that owing to unforeseen contingencies representatives of both Japan and the Panama Canal Commission could not have been present with us to give details of their work as had been hoped for and planned. In malaria, practically the same measures are to be employed as in yellow fever, both of them involving the necessity for biological knowledge, as it is very important to know and recognize the different members of the mosquito family. The activities of flies, bugs, vermin and other such agencies in the spread of disease have to be recognized and familiarity with general biological principles is demanded on the part

of the health official. The chemist must be utilized in the study of foods, water and sewage as they relate to the health of the public. Engineers now are specially trained in public health lines so that municipal and sanitary engineering are taught in certain of the technical schools and universities. The city in which we meet furnishes many communities with experts along such lines through the Massachusetts Institute of Technology. The Massachusetts State Board of Health, by its scientific investigations in water supply, sewage disposal, food adulteration and kindred problems, has won the respect of sanitarians throughout the world not only by the methods evolved but by results achieved. With the certain knowledge now available through our sanitary clinicians, statisticians, engineers, bacteriologists, biologists and other specialists, it would appear to be a relatively simple matter to conserve public health, but there are certain other factors which must be recognized and dealt with.

Apart from the difficulty of establishing satisfactory disciplinary measures in our free countries, it must be remembered that life in this year of 1905 is extremely complex. Our cities have grown enormously. Facilities for rapid transit now make it possible for individuals to reside many miles from their work. Groups form and re-form many times a day and it is impossible to know the exact previous environment of each individual who helps to constitute a particular group. Rapid transit means increased responsibilities for sanitarians. Our programme this year deals with this question. The grouping together of individuals in schools, colleges, religious institutions, offices and shops calls for a study of public health along social economic lines. Specialism in commercial and professional life is so great that we have diseases incident to occupation. It is very apparent that the difficulties of protecting the public against itself are increasing every day and that both highly specialized and very broad general knowledge must be available in those who are united together in this work. No one individual can acquire, so as to be able to utilize, all of the specialized knowledge in these various lines. It becomes necessary therefore to have all such branches available and co-ordinated.

A short consideration of some features of necessary co-ordination may not be amiss. Whilst we are often described as a practical people, impatient to utilize results rather than to acquire the original scientific data by tedious research, the description is true only in part. Anaesthesia by ether, the determination of the causative factor in yellow fever and many other both scientifically and universally important discoveries have had their origin here. The brilliant work of Americans in the study, prevention and cure of tuberculosis is universally recognized

and Theobald Smith, Ravenel, Pearson, de Schweinitz, Biggs, Trudeau, Bowditch, Knopf, Flick and others are household names the world over. The ideal co-ordination of effort in the fight against this dread disease has been secured and the National Association for the Study and Prevention of Tuberculosis will doubtless be the means of stimulating local effort in the utilization of every honorable means to educate and protect humanity. The recent meeting of the Association, where all phases of private and public activity were considered and studied in relation to the scourge, seemed to render it unnecessary for our Association by devoting much time to the subject at this meeting to attempt to duplicate the efficient work already under way. This kind of work shows the power and ability of our people and it may be said that no countries excel those of America in the application of scientific methods to the protection of public health. The vastness of the countries and the possession of potential rather than actual wealth in the newer communities render the work more difficult, but as a compensation there is a corresponding freedom from the chains imposed by precedent and tradition. We are in the process of manufacturing these latter. Laboratories are utilized almost universally in America in public health work. There are, however, many misconceptions in regard to the function of the laboratory in public health service. Primarily, the work undertaken by such laboratories should be in direct relation to public service and not as a means of gratifying private curiosity or of affording information which is of value to individuals alone. Laboratory work should be extended wherever possible so as to afford guidance to executive action. This does not at all mean a limitation to pure routine. Research is necessary; in fact, demanded along many lines. It should have for its object the study of conditions in order to obtain information which may serve as the immediate or future basis of executive protective activity and legal restriction. Universities, special institutions for research and private and hospital laboratories are available for the study of diagnostic and curative methods applicable to the individual rather than to the public, but it is in the public health laboratory that research along public health lines must be done.

In municipal health work the laboratory is in close contact with the problems to be studied, but very frequently it is necessary for the laboratory men to leave the laboratory and to accompany executives, inspectors or others, so as to see and know the actual existing conditions and guide their work accordingly. In state or federal work, it is often imperative for the laboratory worker to visit the locality under investigation. It is impossible, in most instances, to render valuable service or to give intelligent advice based on shipped specimens

and meager data. Nor is it economical to spend days, weeks or months, in working at problems which have been entirely obscured or at best rendered vastly more difficult by lack of foresight or of specific knowledge on the part of those for whom the investigations are to be made. Our experts have endeavored for years to show the impossibility of giving specific information in relation to the sanitary quality of waters or the location of contaminating foci and to afford advice involving structural and other details by the examination of samples collected and shipped to the laboratory. The delay between collection and analysis has been an element of error and even more so in sewage works, although at this present meeting we are to receive information concerning the collection and preservation of sewage samples for analysis. Certainly in bacteriological work it would seem strictly proper to begin the analysis of water and sewage in the field. In the examination of blood for *plasmodium malariae*, of sputum for *B. tuberculosis*, of blood for the presence or absence of the Widal reaction in typhoid fever and of cultures taken from the throats and noses of suspected diphtheria cases and in a number of other lines, including rabies, glanders, anthrax and actinomycosis, it is usually possible for the laboratory to examine and report upon shipped specimens where intelligence has been exercised in their collection and transmission. At best, however, it is not ideal, because the value of data is frequently not appreciated by the person who desires the examination. Furthermore, to be of value to a public health administrative body, each piece of work should be capable of utilization as a guide to future work. Every individual who utilizes a public health laboratory for securing information should feel under obligation to make the necessary return for such gratuitous expert report, by supplying all data in regard to past and present conditions and subsequent history of events so that the whole may be recorded in such form as to be of permanent value to the particular locality and to sanitarians in general. No work on the laboratory or executive side should assume such routine form that it ceases to possess interest. The research spirit should so dominate the work that even in matters of so-called routine, observations and records are made in such manner as to afford the possibility of arriving at new and conclusive views. Boards of health and officials to whom this research spirit is lacking are sources of danger to their communities.

When so much emphasis is laid upon the use of scientific methods in medicine and public health there is danger that in the recognition of the value of such laboratory investigation and minute technical observation the absolute necessity for sound judgment and ability to

appreciate relative values of the points brought out by such precise methods may be underestimated. It is too often assumed that in the various chemical, bacteriological, biological or mechanical tests, the correct information and conclusions are rapidly and almost mysteriously attained. Many of the methods are most laborious and time consuming. The microscope, the culture tube and the chemist's balance and retort are extremely delicate implements, which bring to light many new and sometimes complicating factors. Really at times they almost seem to increase the difficulties and to lead away from practical results. Here is where the necessity for sound judgment, so erroneously designated "common sense," becomes most important and where a knowledge of all local conditions must be considered and correlated with all other data. *The only remedy for apparent discrepancy is more data and further study.*

In regard to the problems undertaken by sanitarians and laboratories as a general principle, the epicurean doctrine must prevail. Questions which involve the welfare of many should receive consideration before those which concern the interests of individuals. Problems for whose solution there seems to be a reasonable hope must take precedence over those in which there appears to be little likelihood of arriving at definite results.

Public health authorities, established for and by the whole people, should be independent of the coercion of individuals. Because a board of health is a public institution is no reason why any individual should demand investigation of the problems which interest him alone. Those who are actively engaged in public health service should be selected primarily on account of their fitness and because the people have confidence in them. To them should be entrusted not only the carrying out of the necessary work, but the *formulation* of that work. Sanitary laws and ordinances should either be formulated by health authorities or submitted to them for approval or modification, and bodies whose duty it is to enact legislation should be guided by those who are entrusted with the protection of the public health. It is illogical to place individuals in positions of trust and responsibility and to hedge them in by suspicion or by perverse or inefficient legislative measures so that the successful carrying out of the work is impeded or prevented. Responsibility without adequate authority is farcical.

It is apparent, as we have seen, that nearly every phase of human knowledge must be utilized in successful effort to protect the health of the public. Usually upon one individual the administration of the work falls. This being so, it is absolutely essential that he keep in touch with the other phases of the work and be versed in their prin-

ciples at least. The composite judgment of all the available experts should be secured and included in any final opinion which the executive voices, and, so far as it can be done, expert work should serve as the basis of all executive action. Importance of close contact of laboratory workers with field problems can not be overestimated. The correctness of this conclusion has been proven by an experience of several years in State Board of Health work in Minnesota. To facilitate such work, branches of the State Board of Health laboratory are being established throughout the state. In the saving of time, the accuracy of information received and the applicability of results of laboratory investigation to the work in hand, much is gained by such means. Where branch laboratories do not exist, one or more laboratory men accompany the executive officer or his representative into the field or at times the laboratory man is entrusted with executive power. A number of state institutions and hospital laboratories throughout the state are frequently used as temporary headquarters. It has been suggested, however, that, for many phases of the work, a traveling laboratory, which can readily be provided in a railway coach, would be most advantageous, as it would permit certain laboratory work to be finished much more quickly, and, in any event, it could be begun on the spot and completed in the main laboratory. In general, problems including epidemics of the various bacterial or parasitic diseases, water, sewage, milk and food investigations and other matters, necessitating the presence of the laboratory worker in the field, such a traveling railway laboratory, side-tracked for the purpose, would be most useful in the saving of time and effort and in serving as an object lesson. The financial consideration would be very much less than that incurred by the provision of innumerable laboratories on a permanent basis in rural districts or small towns and villages. The chief benefit secured would be in the co-ordination of effort by the authorities and the instruction of the public in its own welfare. Such a plan was utilized most advantageously by Dr. Hamilton Wright in the Federated Malay States.

Railways find it most advantageous to provide themselves and the engineering departments of certain universities with laboratory cars, containing instruments of precision and facilities for observation in their important problems, such as conservation of power, the adjustment of grades and the relation of speed to expense. Commercial enterprises and government and state departments have realized the utility of traveling laboratories in agricultural education, whereby demonstrations can be given to farmers and others as to the most scientific and practical methods of increasing and conserving the crop yield.

Each one of us has a different set of problems to solve, and it would be idle to attempt to go into all the various phases of work represented in our Association. Our annual meetings permit each one of us to profit by the experience of others engaged in similar or parallel work. It has been the aim of the Association, from its very beginning, to stimulate research and to standardize methods of technical and executive procedure. With the growth of the countries represented and the gradual organization of new territory, our Association has kept in touch. The increasing tendency to utilize methods of science and accuracy in medicine and commerce has been shared in, or perhaps led by the Association in the establishment of its Laboratory Section. Considerable trepidation was experienced by many members, for fear that in the division of the programme interest might be divided. The real need which has existed has been fully demonstrated by the history of the Section, which has shown the value to be obtained from the meeting together of technical men in the evolution and standardization of methods and interpretation of results. Upon the executive officer falls the necessity and responsibility of taking definite action, to suppress, eliminate or prevent conditions which are inimical to the health of the public. The technical worker is apt to become interested rather in his methods or scientific results than in their practical application. The effect of the establishment of the Section has been to interest each different worker in the problems and affairs of his colleagues in the same and other lines, and the blend has been beneficial. In this day of specialism it is necessary at all times to keep the inter-relation of the various phases of the work most clearly defined, and there is room for question as to whether the present arrangement of the programme for our annual meetings is best suited to our needs. Undoubtedly we need one technical section, and probably should have more. It may appear desirable perhaps to consider a greater subdivision into sections, such as executive, statistical, bacteriological, chemical and engineering sections. Each section should include in its sectional business and programme only those matters which involve technical points. The bacteriologist is interested in matters which pertain to the making of culture media, the preparation or technique of some particular stain and similar procedures, but every member of the Association is interested to know the general principles which underlie these matters and particularly interested in the results to be obtained by their application. A chemist is not necessarily interested in structural materials or the methods employed in estimating engineering problems, but chemists and all other members of the Association are interested in the results achieved by engineers, and the general plans and principles of

the work which they undertake. The minutiae of chemical technique are profitable only to the chemist. Executive details and legislative matters are of chief interest to those who are entrusted with the administration of such affairs in their own communities and the other technical workers are interested only in a general way or in so far as these matters affect or complicate their work. It would be necessary, however, to scrutinize programme material very carefully in order to determine whether it is of sufficiently technical character to be of interest only to a particular group of technical men or if it is of general interest. If it is not particularly technical, and deals with matters of general interest and importance, it should certainly be considered in general session. Most of the work undoubtedly should be done in joint session so that all members may participate and the meetings may continue to be the means of harmonizing rather than separating the various active factors in public health work. The ideal arrangement would consist in the grouping of allied subjects. To illustrate, a joint session on the subject of typhoid fever would be valuable. The bacteriologists might present papers dealing with such general matters as methods of isolating *B. typhosus* from various sources and the germicidal effects for typhoid bacillus of certain substances with which they may have experimented; or, of their experience as to the value of the so-called Widal reaction; or, of the persistence and localization of *B. typhosus* in the human body. All of these matters should be presented in the most practical way without emphasis upon minute technical details. Both chemists and bacteriologists might be able to afford data concerning food, milk and such other materials in relation to the spread of typhoid fever. Engineers should participate in such a programme, giving the results of their inspection and investigation of water supplies and sewage disposal. Executive officers and statisticians should give their experiences, including the use of legislative machinery, the administration of regulations and the compilation of statistics, and the relation of the disease to railway travel and military life should not be overlooked. Such a method of approaching problems would enable each worker to share or change the point of view of his fellows and a far greater value would be received by all than if all of each technical worker's experience and results were to be given before his particular section simply because his communication contained technicalities. These technicalities should be eliminated from the general paper and presented in the briefest possible way and usually in demonstration form before the particular technical section to which he belongs.

The American Public Health Association is the only association of

any magnitude which is devoted entirely to the interests of public health. Its traditions are that it should be big enough and strong enough to meet emergencies and keep pace with or rather to anticipate advance. Every one in this age and generation is familiar with the trust method as applied to commerce. Its opponents are loud in their denunciation of the method—not because it does not succeed, but because it succeeds too well. The success of the trust is due to the fact that every method and every agency which can be advantageously used is used. There is a complete correlation of all potent factors. Such should be the attitude of our Association, and success will attend our efforts if made along these lines for the benefit of the people whom we serve.

The work of the American Medical Association in the organizing of physicians throughout the United States is one of the greatest advances of the present time. This work is very largely entrusted to one of the oldest and most valued members of our Association, and it is impossible to estimate the real good which is being accomplished by Dr. McCormack in persuading members of the medical fraternity to drop all points of difference and unite upon those matters which are common to all and for the good of all humanity. This work of organization does not contemplate for a moment interference with other more highly specialized or technical medical associations. It will be of the greatest possible benefit to our Association, which has a field peculiarly its own.

It should be the policy, however, of the American Public Health Association to anticipate demands for special work and special information along lines which are closely applicable to public health, and care must be taken that, in our land of societies without number, we do not lose because we have failed to provide a place and a stimulus for workers in all lines which directly affect our work.

There are great difficulties to be met and overcome. Not least is the instability of local organizations, and our Association should at all times endorse the great value of experience and the importance of continuing competent workers in their position. Efforts should be made not only to enlist the active co-operation of every good public health worker in America, but to retain him in active membership in our Association. It is axiomatic that what is difficult to obtain is appreciated. On this principle it may be wise to consider the desirability of a more careful selection and rigid censorship of the membership of our Association. Another point worthy of consideration is the effect upon our meetings of selecting some central location as a permanent meeting place if the educational effect both upon the Association and

the locality visited would not be lost. Succeeding meetings now may be held many hundreds or thousands of miles apart, rendering it at times very difficult for members to attend. The time of meeting also should be considered in relation to universities, because of the necessity which all recognize of securing the co-operation of educational institutions in the general teaching of hygiene to all and in the specific training which is essential for those who are afterwards to engage in public health service.

The dignity and permanency of the American Public Health Association may be taken for granted, and it must continue to feel its responsibilities so that it may become advisory to the governments of those countries which constitute the Association. But the question arises as to whether its present constitution, which provides for an annual meeting lasting five days with a complete interregnum of 360 days in each year, is best calculated to meet emergencies and bear responsibilities and tends to permanency of structure and administration. There are many matters which arise between meetings which demand careful consideration and immediate action.

The publication of the transactions of the Association is a matter which has engaged our attention for years, and is still unsettled partially through lack of funds and partially on account of our peculiarity of organization. The question of income, so that research may be fostered and possibly studentships or fellowships established for the study of specific problems, is an important matter which we should consider. I would suggest that at this meeting the Association take under advisement some of the matters touched upon and that the possibility of certain changes in organization be considered. To secure greater permanency of administration, and for the purpose of carrying on at all times the necessary business and of increasing available funds, it might be well perhaps to consider the establishment of a board of trustees similar to that of the American Medical Association. The administration of the affairs of the Association could be safely left to such a board, which should represent every phase of public health activity and whose members should be long enough in office to ensure the carrying out of permanent policies.

Public health work, in the main, consists in making people do what they do not wish to do for their own good, and is certainly not a popular profession. As one of the younger members, I can not but speak with enthusiasm of the work and achievements of the older members of our Association, which, through their efforts, has been such an active factor in public health work for over three decades. Their motto has been to retain what is good but to be on the watch for

something better. It must be remembered that this is a work in which many of our members have been engaged for the greater part of their lives, with relatively little in the way of financial encouragement and at times nothing in the way of appreciation of what they are doing by those for whom they are doing it. Their reward should be the contemplation of and participation in the working of a huge machine of which the constituent parts, revolving though they may be in intricate and complicated cycles of their own, operate with no loss of energy in friction for the benefit and conservation of mankind.

EXPERIMENTS ON THE PURIFICATION OF BOSTON SEWAGE, 1903-05.*

BY C.-E. A. WINSLOW AND EARLE B. PHELPS, OF BOSTON, MASS.

INTRODUCTORY.

The Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology was established by a friend of the Institute for the purpose of making experiments and promulgating information with regard to the scientific disposal of sewage, especially the sewage of large cities.

The laboratory and station are situated in the southeasterly part of the city of Boston, near the corner of Massachusetts Avenue and Albany Street. Connection is made by a two and one-half inch iron pipe and suction hose with the nine-foot sewer of the Boston main drainage system at a point on Massachusetts Avenue, about 200 feet below the entrance of the Albany Street intercepting sewer. Prior to October 14, 1904, sewage from the whole of Boston south of the Charles, with the exception of the Dorchester and South Boston districts, together with sewage collected by the South Metropolitan sewerage system, from Waltham, Newton, Watertown, Brighton and Brookline flowed past the station intake. In 1903-04 the flow at the station was above fifty million gallons a day from a district with a contributing population of 350,000, seweraged for the most part on the combined system.

The sewage, drawn from the sewer by a 4 by 6 duplex Warren power pump, passes through a grit chamber made of an iron casting 16 inches deep and 19 inches in diameter, with a central screen having one-half inch openings. Here the velocity of the sewage is checked to .04 feet per second for about 45 seconds. The sand and other detritus taken from this chamber amounted in sixteen months to 4,800 pounds of wet material or .65 cubic yards per million gallons of sewage. Analysis indicated that the 4,800 pounds of detritus contained 1,300 pounds of water, and only 319 pounds of organic matter. As a whole the material was of an innocuous character, and during the whole course of our experiments it was spread out on the land adjoining the station without producing any nuisance.

* Preliminary Abstract.

THE CRUDE SEWAGE.

The average yearly results of almost daily analyses of the crude sewage as it reached the station after passage through the grit chamber are given in Table I.

TABLE I.
COMPOSITION OF BOSTON SEWAGE.
Parts per million.

No. of Samples.	Date.	Turbidity.	Temperature.	Nitrogen as						2 minutes boiling. Oxygen Consumed.		Oxygen dissolved.
				Alb. Ammonia.			Free Ammonia.	Nitrites.	Nitrates.	Total.	Soluble.	
				Total.	Solution.	Suspension.						
102	June '03-											
159	June '04.	.....	60	6.33	3.11	3.22	19.7	0.27	0.06	45.2	22.5	2.8
	June '04.											
	June '05.	305	58	5.67	2.96	2.71	17.6	0.14	0.12	41.5	24.6	2.2

The organic constituents of the Boston sewage are quite normal in their relation to one another. Regular determinations of the organic nitrogen were not made, but judging from the average of some fifty such determinations made at various times in the course of experimental work, it may be stated that the organic nitrogen figures for the whole period average about 20 parts per million. In this respect the sewage appears to be about the same strength as the average sewage of Massachusetts cities, being slightly weaker than the sewages of Lawrence and Gardner (new system), and somewhat stronger than the sewages of Framingham, Worcester and Brockton.

The inorganic analysis of mixed weekly samples which covered the calendar year 1904 showed 2,300 parts per million of chlorine, 15 parts of iron, 125 parts of alkalinity as calcium carbonate and 220 parts of SO_3 as sulphates.

The high chlorine and sulphate values are due to the large amount of sea water present in the sewage of Boston. Assuming the chlorine, normal to the sewage itself, to be equal to the total nitrogen, a simple calculation shows that the amount of chlorine present represents a volume of sea water equal to 11 per cent. of the total volume of the sewage. This, however, is only an average value for the period.

During each twelve hours the chlorine reaches a maximum figure of from 3,000 to 4,000 parts per million, representing 19 per cent. of sea water, while between these maxima there are minimum points of about 200 parts per million representing only one per cent. of sea water. It may be an important question in any project for the purification of Boston's sewage whether the extra cost of pumping and treating this amount of sea water might not be greater than the cost of keeping it out of the sewers. In this connection it might also be well to consider the possibility that a large amount of sea water, saturated as it is with oxygen, may be of actual advantage in any aerobic process of treatment.

The suspended solids, amounting to some 300 parts per million, are considerably higher than the average for American sewages.

THE SEPTIC TANK.

Assuming that if any preliminary treatment were necessary in the purification of Boston sewage, the septic tank would probably furnish the most available method, the next problem was to determine the best conditions under which a septic tank could be operated. In particular we desired to compare the efficiency of different periods of storage, the results obtained from open and closed tanks and the effect of filling a tank with stone in order to increase the amount of surface action.

Our experiments were carried out in six cypress tanks, each 6' x 4' x 3' deep. Tanks 7 and 9 were open. Tanks 5, 6, 8 and 10 were closed in with tight planking, Tank 6 was filled with 1½" crushed stone. The rate and the average analysis for each effluent are shown in Table II.

TABLE II.

ANALYSIS OF CRUDE SEWAGE AND SEPTIC EFFLUENTS.

General Averages.

(Parts in 1,000,000.)

	Date.	Storage Period. (Hours.)	Turbidity.	Temperature.	Nitrogen as				Oxygen Consumed. 2 minutes boiling.	
					Alb. Ammonia.			Free Ammonia.	Total.	Soluble.
					Total.	Solution.	Suspension.			
Sewage	June 1903.									
	June 1905.		305	59	5.94	3.02	2.92	18.5	43.1	24.4
Sewage	Mar. 1904.									
	June 1905.		305	58	5.66	2.97	2.65	17.6	41.5	24.7
Tank 5	June 1903.									
	June 1905.	48-12*	200	57	3.80	2.64	1.16	20.7	36.9	26.9
Tank 6	June 1903.									
	June 1905.	24	175	57	3.41	2.52	0.89	21.5	37.8	26.0
Tank 7	Mar. 1904.									
	June 1905.	12	170	55	3.37	2.50	0.87	17.6	33.2	27.9
Tank 8	June 1903.									
	June 1905.	48	190	57	3.84	2.58	1.26	22.1	40.7	29.9
Tank 9	Mar. 1904.									
	June 1905.	24	170	55	3.24	2.43	0.81	19.4	34.1	27.5
Tk. 10	June 1903.									
	June 1905.	24	210	56	3.77	2.53	1.24	22.5	37.5	24.5

* Changed December 7, 1903 from 48 hours to 12 hours.

Septic action began in all the tanks very soon after they were started, the effluent being free from gross turbidity and much darkened. The dark color and offensive odor of the septic effluents are undoubtedly due in part to the formation of sulphides from the sulphates introduced in the sea water. Scum formed at first on the open tanks, but later disintegrated and sank without reforming. In the closed tanks a scum an inch thick was found when they were finally opened.

Inspection of Table II shows that the septic tanks reduced the total albuminoid ammonia to from two-thirds to one-half its sewage value. The diminution of dissolved albuminoid ammonia was slight but distinct, while the suspended portion was reduced to a little over one-third its original amount. Comparison of the different effluents shows a remarkable uniformity of results. In comparing tanks 5 and 10 (closed) with the corresponding 12 and 24 hour open tanks, the open-

tank effluents appear to be slightly better. It must be remembered, however, that the open tanks were operated during the last fifteen months only, when the sewage was weaker. Taking this factor into account the work of the open and closed tanks is practically equal.

With regard to period the figures are no more conclusive. Comparing tanks 7 and 9 (open), there appears to be no important difference between the effect of 12 and of 24-hours' storage. Similarly, tanks 5, 8 and 10 (closed) produce almost the same results, although operating with periods varying from 12 to 48 hours. The length of the storage period seems therefore not to be a matter of great importance. Tank 6, with $1\frac{1}{2}$ " crushed stone, produced a somewhat greater reduction in suspended albuminoid ammonia than did the other tanks; but the difference is too slight to be of great practical importance.

When this series of experiments was closed in June, 1905, the inlet and outlet of each tank were closed and the contents, including scum and sludge, thoroughly stirred. Samples of the suspension thus produced were then analyzed in order to gain an idea of the material which had accumulated during the whole period of operation. From the results we have calculated, in Table III, the actual amounts of certain constituents which were (*a*) allowed to enter the tanks, (*b*) discharged in the effluents, (*c*) stored in the tanks as sludge and scum, and (*d*) removed by septic decomposition. About 50 pounds of nitrogen as albuminoid ammonia per million gallons of sewage entered the tanks; 30 pounds, roughly, were discharged and 20 pounds remained behind, of which from 15 to 17 pounds were decomposed. The last columns in the table show the total volatile solids and fats stored in the various tanks calculated in relation to the sewage treated. These figures bring out very sharply the superior decomposing power of the tanks operated at short periods. Tank 7 (12 hours) and tank 5 (12 hours for the last eighteen months) show the lowest values. Tanks 9 and 10 (24-hour period) come next, with 90 and 101 pounds respectively. Tank 8, with its 48-hour period, stored 206 pounds of organic matter per million gallons of sewage treated. The large proportion of fats indicated in the last column is notable, amounting as it does to one-fourth or one-eighth of the total stored organic matter.

Altogether we may conclude from our experiments that the septic tank will effect a considerable removal of solids from Boston sewage, amounting to some two-fifths of the nitrogen as measured by albuminoid ammonia. Its effluent is free from gross turbidity, but dark and offensive from the liberation of hydrogen sulphide. Of the organic matter retained in the tank a very large proportion, amounting to well over three-fourths if measured by the albuminoid nitrogen, is

decomposed and the accumulation of stored material in the tank is slight after two years of operation. Apparently such tanks might operate for several years without being cleaned. The covering of tanks is immaterial since closed and open tanks work equally well. Storage periods, varying from 12 to 48 hours, give similar effluents, but there is an increasing tendency to accumulate sludge as the period is lengthened. This, may probably be due to the accumulation of harmful bacterial products which check the liquefying organisms. The filling of a septic tank with stone is of only slight advantage.

TABLE III.

STORAGE AND DECOMPOSITION OF ORGANIC MATTER IN SEPTIC TANKS.

(Pounds per million gallons.)

	Flow. (Gallons.)	Storage Period. (Hours.)	Nitrogen as Albuminoid Ammonia.				Solids Loss on Ignition Stored.	Fats Stored.
			Entering.	Leaving.	Stored.	Decomposed.		
Tank 5.....	445,000	48-12*	49.2	31.7	1.3	16.9	69.0	16.2
Tank 6.....	135,000	24	49.2	28.3	10.1	11.9	.....	101.
Tank 7.....	393,000	12	46.7	28.3	.4	18.1	35.3	6.3
Tank 8.....	133,000	48	49.2	31.7	2.6	15.9	206.	29.3
Tank 9.....	197,000	24	46.7	26.7	1.5	17.8	89.7	25.0
Tank 10.....	266,000	24	49.2	31.7	1.6	17.3	101.	15.3

* Changed December 7, 1903, from 48 hours to 12 hours.

THE INTERMITTENT SAND FILTER.

The sand filters studied were cypress tanks, 6' x 4' x 3' deep. Over 6" of underdrain material, graded from 3" stones down, was a layer of drift sand of an effective size of .14 mm. and a uniformity coefficient of 3.5. The sand in tank 2 was one foot deep and in tanks 1, 24 and 25, two feet deep. Tanks 1 and 2 were dosed with crude sewage, tank 24 with 12-hour septic effluent, and tank 25 with 24-hour septic effluent. The rate on tanks 1 and 2 was at first .1 million gallons per acre per day, but on tank 1 it was gradually worked up to .4 million gallons per acre per day, the daily dose being divided into four portions, applied at six hours' intervals.

These experiments gave quite conclusive results as to the minimum

depth for a sand filter. Tank 2, with its one foot of depth, proved a complete failure. Its effluent was dark and turbid, and offensive in odor. Not one of the samples tested passed the incubator test. The analytical results showed marked variations from time to time, but the free ammonia present was generally from 15 to 20 parts per million, nearly as high as the crude sewage. The albuminoid ammonia was usually between 2 and 3 parts, and the oxygen consumed in the neighborhood of 20 parts, in each case about half the sewage value. Nitrates were always low.

The operation of the other beds, on the contrary, was eminently satisfactory. All three effluents were clear and bright, entirely free from turbidity and odor and stable by the incubator test. The average analyses in Table IV show that the effluent from the treatment of crude sewage was slightly better than that produced by the treatment of septic effluent. The increase in rate on tank 1 from .1 to .2 and again from .2 to .4 did not appreciably alter the quality of its effluent.

TABLE IV.
ANALYSIS OF SAND FILTER EFFLUENTS.
(Parts per million.)

Tank.	Receiving.	Nitrogen as				Oxygen Consumed. 2 min. boiling.	Oxygen dissolved.
		Free Ammonia.	Alb. Ammonia.	Nitrites.	Nitrates.		
1	Crude sewage	4.2	.6	.4	22.3	5.6	6.1
24	12-hour septic effluent.....	5.0	.8	.3	19.9	6.5	7.5
25	24-hour septic effluent.....	5.6	.9	.2	16.0	6.5	7.2

The surface of the filters, even at such high rates, did not require undue care. Tank 1 was scraped in August, 1903, and November, 1904, and raked once and scraped once in March, 1905. The total material removed in three scrapings during two years of operation, amounted to a layer .48 inches in thickness or 1,600 cubic inches. The filters taking septic effluents showed still more favorable results. During their fifteen months of operation tank 24 was raked over twice and scraped once, while tank 25 was raked over once and never scraped.

In general our results indicate that in reducing the depth of a sand filter it is not safe to go below 2'. A single foot of sand is insufficient to produce purification, while a two-foot bed may yield admirable results. With regard to the value of preliminary septic treatment of Boston sewage before sand filtration, it appears that effluents from the combined process are slightly inferior to those obtained by the sand process alone, while the care of the surface is more difficult when crude sewage is treated. We believe our experiments indicate that it may be possible to treat crude sewage by sand filtration at higher rates than have heretofore been recommended. We are aware that the operation of filter beds under practical conditions is much more difficult than in such experiments as ours, on account of imperfect distribution and the detrimental effect of severe weather conditions. Yet we believe that our results suggest the possibility of operating sand filters, with proper care and the application of several doses of sewage during the twenty-four hours, at higher rates than those commonly in use.

THE CONTACT BED.

The experiments on contact treatment were made in cypress tanks four feet square, four being four feet deep and five, six feet deep. Of the six foot single-contact beds, two were filled with $\frac{1}{2}$ " broken stone, one with 1" broken stone, one with $1\frac{1}{2}$ " broken stone and one with 2" coke. During the second year the one-inch tank was emptied and refilled with facing bricks, laid in even tiers after the pattern of Dibdin's multiple-surface bacteria bed. The four-foot double contact beds were so arranged as to give two primary beds of $1\frac{1}{4}$ " stone, and two secondary beds of $\frac{1}{2}$ " stone. One pair took crude sewage and the other pair septic effluent, which had received thirty hours' treatment.

In each case the mode of operation was as follows: the bed was filled during the course of an hour, allowed a two-hours' contact period, emptied in about half an hour and allowed to stand empty till the next filling. All the beds were started with one filling a day. In August, 1903, the rate on four of the single contact beds was increased to two fillings and that on the fifth to three fillings a day. The higher rate seemed to give better results so in January, 1904, the rate on the four beds was again increased to four fillings. This proved somewhat too strenuous, however, and since June, 1904, all the beds, single and double alike, have received three fillings in the twenty-four hours.

Capacity measurements were made on each bed once a week by discharging the effluent into a measuring tank. The initial liquid capacity varied from 39 per cent. to 48 per cent., the highest values, of course, being found in the brick and coke beds. The single contact beds

taking crude sewage all decreased in capacity quite steadily, reaching a final value, after two years, of 26-33 per cent. The Dibdin brick filter still showed 40 per cent. open space after one year of operation. The first contact bed receiving septic effluent, and both second contact beds, maintained capacities of over 35 per cent. The loss of capacity was made good to some extent by resting.

The average analyses of the effluents from the various beds are brought together in Table V.

TABLE V.
GENERAL AVERAGE ANALYSES OF CONTACT FILTER EFFLUENTS.
(Parts in 1,000,000.)

Filter.	Date.	Material.	Size of Material.	Average Rate.	Turbidity.	Temperature.	Nitrogen as					Oxygen Consumed. 2 minutes boiling.		Oxygen dissolved.		Capa- city.	
							Alb. Ammonia.			Free Ammonia.	Nitrites.	Nitrates.	Total.	Soluble.		Initial.	Final.
							Total.	Solution.	Suspension.								
Tank 11	June '03-June '05.	Coke	2 "	1.8	130	57	3.16	2.17	0.99	18.9	.45	1.08	22.1	15.5	0.50	46	32
Tank 12	June '03-June '05.	Stone	1½"	1.4	130	57	3.15	2.12	1.03	17.6	.52	1.34	25.3	16.3	0.40	40	30
Tank 13	June '03-June '05.	Stone	1"	1.2	55	56	1.96	1.45	0.51	11.0	.69	7.22	14.3	9.8	1.37	44	33
Tank 14	June '03-June '04.	Stone	1 "	1.4	155	57	3.56	2.43	1.13	20.0	.49	0.04	28.3	14.0	0.36	42	...
Tank 14A	June '04-June '05.	Brick	.....	2.0	195	57	3.89	2.38	1.51	16.4	.23	0.38	27.5	20.4	1.42	48	40
Tank 16	June '03-June '05.	Stone	1"	1.2	65	58	1.73	1.34	0.39	8.1	.83	9.80	13.1	9.6	1.28	42	30
Tank 17*	June '03-June '05.	Stone	1"	1.2	80	55	2.26	1.70	0.56	15.5	.35	5.20	16.9	11.7	0.55	39	35
Tank 18*	June '03-June '05.	Stone	1"	1.1	80	57	2.11	1.49	0.62	11.5	.67	8.60	16.1	12.4	1.25	42	37
Tank 19†	June '03-June '05.	Stone	1½"	1.2	155	56	3.33	2.28	1.05	20.9	.21	0.91	28.0	19.0	0.38	41	38
Tank 20	June '03-June '05.	Stone	1½"	1.1	120	57	3.64	2.48	1.16	15.4	.50	4.01	22.4	15.4	0.34	41	26

* Second contact beds.

† Receiving septic effluent.

With regard to kind of material, a comparison of tank 11 (2" coke) with tank 12 (1½" stone) shows that the effluent of the former was slightly better than the latter, in spite of the larger size of the material and the higher rate.

On the more important question of the size of material, a comparison of tank 12 (1½" stone), tank 13 (½" stone) and tank 14 (1" stone) is instructive. The effluents from the 1" and 1½" stone were never of satisfactory quality except, in the latter case, at the very end of the experiment, while that from the ½" stone was generally clear and non-putrescible. The result in this case was only reached, however, at the expense of a serious clogging which necessitated the removal of four inches of sludge from the surface during two years of operation, leaving the body of the filter for some way below the surface still badly clogged. These results correspond with those obtained by Dunbar and other German investigators. They show that with beds of fine material a good effluent may be obtained by a single contact, but at the cost of such clogging as to necessitate somewhat frequent removal of the upper portion of the bed.

Data bearing on the effect of contact beds of different depths may be obtained by comparison of tanks 12 and 20. Both were filled with 1½-inch stone and dosed with three fillings a day of crude sewage. The depth was six feet for tank 12 and four feet for tank 20. It is apparent that the results of treatment in the four-foot bed are consistently better than in the six-foot bed. In particular it will be noticed that the nitrification is more complete in the shallow filter; but the difference is scarcely great enough to compensate for the diminished rate.

A comparison of the double contact systems, 17 and 19, and 18 and 20, furnishes interesting results with respect to the value of preliminary treatment. The primary beds were both 4' tanks filled with 1½" stone. It will be noticed that the effluent of tank 20, which took crude sewage, was markedly superior to that of tank 19, dosed with septic effluent, except, for part of the time, in its albuminoid ammonia content. The effluent from tank 20 was often non-putrescible while that from tank 19 was always foul and offensive. As pointed out above, the septic treatment was efficient in preventing clogging, the final capacities of tanks 19 and 20 being 34.6 per cent. and 26.5 per cent., respectively. This advantage is, however, dearly bought, since the septic effluents from Boston sewage evidently contain substances inimical to bacterial action which seriously interfere with subsequent purification. Even the secondary filter effluents showed the same deleterious effects. In nitrogenous constituents and in available oxy-

gen, the effluent of tank 18 was better than that of tank 17. The former was clean and stable, the latter generally dark colored and smelling of hydrogen sulphide.

In general it appears that a single contact treatment will remove from one-third to one-half of the organic constituents of sewage with the production of an improved but still putrescible effluent. Beds of $\frac{1}{2}$ " stone form an exception to this rule, since after a time they may yield a stable effluent, but at the cost of very serious surface clogging.

Secondary contact treatment effects a removal of one-third to one-half of the remaining organic matter, producing a satisfactory effluent in the case of the treatment of crude sewage. Preliminary septic treatment for thirty hours, although it maintains the capacity of the beds, exerts a detrimental effect in the treatment of Boston sewage, producing an effluent hard to purify even by the double contact system. The possibilities of septic treatment before contact filtration can not be considered as exhausted, since we have only tried rather old septic sewage (30 hours), without any special method of aeration.

CONCLUSIONS.

It will be necessary in any treatment of Boston sewage to screen out large floating bodies and to settle out mineral detritus. In our judgment, this process should be limited to a sedimentation of a few minutes. Under such conditions the settled material amounts to some 1,600 pounds per million gallons of sewage, and is of such a character that it may be spread out on land without fear of nuisance.

A further removal of the suspended organic matter may be effected if desired by treatment in the septic tank. An open tank operates just as well as a closed one, and there is no marked advantage in filling the tank with stone. Varying the storage period from 12 to 48 hours produces no difference in the effluents which is measurable by analytical results. All our tanks removed nearly two-thirds of the suspended albuminoid nitrogen and produced an effluent fairly free from suspended matter, but much darkened by hydrogen sulphide. The tanks on an average received 50 pounds of nitrogen as albuminoid ammonia (dissolved and suspended) of which 30 pounds were discharged in the effluent, 15-17 pounds were decomposed and 3-5 pounds were stored as sludge. In the decomposition of sludge, the length of the septic period is of great importance. The amount of organic solids stored, undecomposed, per million gallons of sewage passed, is twice as great with a 48-hour period as with a 24-hour period and four times as great as with a 12-hour period.

Under the conditions of our experiments, crude Boston sewage has been successfully filtered through a two-foot bed of sand, with an effective size of .14 mm., at a rate of .4 million gallons per acre per day, divided into four doses in the twenty-four hours. We should not expect such high rates in actual practice, but we do believe that with care in construction and operation the sand filter may be efficient at higher rates than has been generally recognized. The effluents obtained from our sand beds were clear and bright and well purified. The depth of the beds can not safely be reduced below 2 feet. Preliminary septic treatment for 12 or 24 hours does not improve the effluents obtained with sand filtration, although it makes the care of the surface of the beds somewhat easier.

Crude Boston sewage may be treated in single contact beds of fine stone (one-half inch diameter) at a rate of about 1.2 million gallons per acre per day. The effluent is only partially purified, although generally so stable as to be discharged into water without any tendency to create a nuisance. The beds clog rapidly and the surface needs much attention. The double contact system of treatment in primary beds of 2" material and secondary beds of $\frac{1}{2}$ " material would yield a fairly well purified and stable effluent at a rate on the combined double system of about .7 million gallons per acre per day with beds 6' deep. Such a system clogs somewhat, and would require resting and renewal at frequent intervals. Preliminary septic treatment for thirty hours enables the beds to maintain a higher capacity but produces an effluent which, without special aeration, is so difficult to purify that their efficiency is seriously interfered with. The most practical method of those which we have studied would appear to be the treatment of sewage, either sedimented or subjected to a very short period of septic action in double contact beds. The process of trickling filtration remains to be considered in a further report.

INDUSTRIAL WASTES AND THEIR SANITARY SIGNIFICANCE.*

BY M. O. LEIGHTON, U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C.

The study of trades wastes has for many years occupied a prominent place in industrial development, but the work has been directed toward the economical recovery of valuable by-products rather than toward the sanitary disposal of polluting materials. So successfully has this work been conducted that in some industries the by-products have become more important from a financial point of view than the original product. The investigations have usually terminated when the prime object of the work has been accomplished and not infrequently the by-product wastes are as objectionable as the original wastes.

Among sanitary investigators in this country the disposal of trades wastes has occupied a position secondary to that of sewage disposal. There have been a few investigations, such as the work of Kinnicutt and Eddy at Worcester, Mass., upon acid iron wastes, the investigations of the Massachusetts State Board of Health and co-operative work now being conducted in Ohio by the State Board of Health and the U. S. Geological Survey, but it is accepted as a matter of course that when a body of sanitarians considers polluting wastes, city sewage is the subject for discussion. Yet the problems resulting from the discharge of trades wastes into streams are often extremely complex and their study should not be neglected. For convenience such wastes may be classified as follows:

1. Those which are putrescible or which induce putrescibility.
2. Those which are germicidal in character, or which inhibit those natural processes by which organic matter is changed to inorganic.
3. Those which appear to be indifferent to ordinary chemical changes, but which silt up streams and produce obstructions.

Industrial wastes do not normally contain the germs of disease. Therefore, from a purely pathogenic standpoint, their relation to sanitation is remote. There are, however, several considerations which render the subject of prime concern to a public health association. Unstable organic wastes such as distillery slops, sulphite pulp liquors; wool-scouring wastes and similar liquors produce a condition of putrescibility

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in streams. While this may not, of itself, be a menace to health, it is certainly included among those objectionable features of modern civilization that by general consent have been turned over to the sanitarian for treatment. Such wastes are largely organic, and when turned into streams provide food for bacteria. Therefore, the specific germs of water-borne diseases which are introduced into these streams by sewerage systems are supported during longer periods and extend their influence for greater distances than would normally be the case. When discharged in large quantities such wastes increase the burden of water filtration systems and in some cases may render them inefficient. In other words, these highly organic wastes are detrimental to rivers from practically all sanitary and economic standpoints.

The wastes from iron-working industries, galvanizing works, soda pulp mills, coal and zinc mines, etc., are the ones which may be grouped under Class 2. Their effects vary according to the character of the waste and the foreign matter in the stream. Their principal detrimental effect is the reduction or prevention of septic action in sewage disposal plants. Some of them render the water hard or otherwise unfavorable for industrial use. Others have a marked precipitating effect when brought into contact with sewage and other organic matter. On the whole their ill effects are confined to the inhibition of natural processes of oxidation which are so important in the self-purification of streams.

Among the wastes which are included in the third class are saw-dust, sand from glass works, culm from coal washeries, etc. Such wastes fill up river channels and consequently retard the flow of water. They are not important from a sanitary standpoint except as they interfere with the natural processes that aid the purification of streams.

DISTILLERY SLOPS.

This waste has been called to public attention by the practice, formerly quite common, of feeding milch cattle upon the waste, and the production of what was commonly called "Swill Milk." Even now the waste is generally fed to cattle which are confined under extremely disgusting conditions. These cattle are not usually kept for dairy purposes, but are fattened for beef and sold at the close of the distilling season. This method of waste disposal results in a more dangerous pollution than would arise from the direct discharge of slops into rivers. There is usually a large amount of waste and this excess together with large quantities of manure is generally turned into streams.

From whatever aspect the subject is viewed, the pollution of streams by distillery slop is a cause of unwarranted damage, a wanton waste of

valuable material, and an evidence of slovenly business methods. Distillery slop is largely composed of valuable food material. The process to which the grain is subjected in the production of distilled liquor extracts from it only the carbohydrates and leaves the greater amount of fat and practically all the proteids. This fact has generally been recognized by distillers and in the majority of the plants the coarsest particles of grain are separated from the liquor by a screen, dried and sold as a food for cattle, the product bringing a good price. It is the liquor and fine suspended matter which passes through this screen that is conducted to the cattle pens located at each distillery.

One of the most valuable investigations carried on under co-operative agreement by the Division of Hydro-Economics, U. S. Geological Survey and the State Board of Health of Ohio, has been that of distillery slops. It was found that distillery slop contains a great quantity of food material of the most valuable character. This material is in solution rather than in suspension, and therefore it cannot be recovered by any method of screening such as is usually resorted to in distilleries. Experiments showed conclusively that it is practicable to evaporate the slop which passes the screens and secure the food material in the residue. The food material by this means is nearly as great in amount as that obtained by screening and in addition is far better and more nutritious. It has been shown that an investment for a plant suitable for the recovery of food material in distillery slop will yield an annual income of from 20 to 45 per cent., according to the conditions. A bulletin upon this subject is in process of preparation.

SULPHITE PULP WASTE.

No industrial waste has presented so many difficulties of treatment or has baffled the skill of so many able men as the liquor derived from treating wood with an acid solution of calcium sulphite in the manufacture of wood pulp.

Wood chips are digested with this acid solution under about 90 pounds steam pressure for about eight hours. As a result of this hydrolytic treatment the gums, resins and in fact all the extractives are dissolved, leaving the cellulose in practically unchanged condition. These extractives, together with the spent sulphite liquors, make up the waste, which is a reddish brown gummy liquor of highly complex chemical character, usually somewhat acid in reaction. When kept by itself in a container it appears to be extremely stable, remaining apparently unchanged both chemically and physically for indefinite periods.

The real effect of sulphite wastes upon streams is probably far less

serious that it appears to be, especially if the size of the stream is sufficient to provide for a fair degree of dilution of the sulphite waste. To the eye and nostrils the conditions created by this waste when it is turned into a stream, are very objectionable. The water is almost black and gives off an odor resembling that of burning rubber. Being of a highly organic nature, the waste quickly consumes all the available oxygen in the water. Fish are killed, and sometimes vegetation has been destroyed. Probably such water, if not otherwise polluted, is not extremely dangerous to health, although it is absolutely unfit for domestic consumption and even cattle generally reject it. These objections are, however, largely those arising from bad color, taste and odor. The waste of itself is not putrescible and there are excellent reasons for believing that it does not induce putrescibility. It has been claimed by some that it will not support bacterial life and therefore is of no real detriment to streams, on the other hand there is excellent evidence that this contention is not well founded. From an industrial standpoint the waste causes serious damage along several lines, especially those of textile manufacturing. From observations made at the Watertown, N. Y., filtration plant, Mr. Allen Hazen states that the waste turned into Black River from numerous mills above the city has apparently no effect upon the efficiency of the filtration process. No data are at hand by which any determination can be made of sulphite waste, nor the dilution which it may receive before reaching the Watertown intake. Nevertheless the observation is of value for purposes of reference.

The waste from the sulphite process contains valuable ingredients and probably the whole question will be solved finally by the discovery of some method by which these ingredients can be economically recovered. A process for the recovery of certain of them is even now being tested upon a working scale. The author is not at liberty to give any specific information concerning this process, but there is every prospect of success. Whether or not the by-products from this process will be more or less favorable to streams than is the waste at present remains to be seen.

WOOL LIQUORS.

A series of experiments was conducted during the period 1895 to 1900 inclusive, by the Massachusetts State Board of Health at the Lawrence Experiment Station, upon the best methods of disposal of wool liquor. No efforts were made to discover any process by which the valuable ingredients in this waste might be recovered, but the work was directed exclusively toward the disposal of the waste in unobjectionable form. The author believes that this constitutes one of the instances in

which a good opportunity for effective work was lost. Wool liquor contains valuable ingredients, and an effort should have been made to provide simple and economical processes to recover them. At a recent meeting of the Manchester Section of the Society of Chemical Industry, a series of experiments was described by Dr. Grossmann, in which it was shown that the valuable ingredients in wool liquor at Bradford, England, can be profitably recovered even after they have been discharged into the sewerage system and subjected to the high degree of dilution which takes place. It is apparent, therefore, that it would be highly feasible to recover valuable ingredients from the undiluted liquor. The feasibility of boards of health considering the recovery of valuable materials in polluting wastes will be discussed in subsequent pages.

The final result of the work above noted is set forth in the Massachusetts State Board of Health Report of 1900, as follows:

“(1) That, while a considerable amount of the matters in suspension in wool liquor will settle when the liquor is held quiet for sedimentation to take place, yet the amount of organic matters carried down cannot be increased materially by the addition of reasonable amounts of any of the chemicals commonly used as precipitants, either alone or in combination with each other; although combinations of ferric chloride and lime in considerable amounts, or lime alone, in some instances, will, when mixed with the liquor from some plants, cause the coagulation and precipitation of considerable organic and fatty matter; (2) that acids will cause a separation of the fats, but an acid liquor is produced that is difficult to treat; (3) that filtration of the strong wool liquor through sand filters is inexpedient, owing to the fact that this liquor will not nitrify by itself and these filters quickly become clogged; (4) that mixtures of the scouring liquor in different proportions with domestic sewage can be purified and nitrified by means of intermittent sand filters; (5) that, if the mixture is held for bacterial growth and putrefaction to occur before being applied to sand filters, it can be purified at a somewhat greater rate and with less clogging of the filtering material; (6) that mixtures of wool liquor and domestic sewage in a proportion that allows of purification in sand filters cannot be purified in contact filters; (7) that the liquor resulting from washing or rinsing wool after scouring can be purified at a high rate in sand filters when mixed with domestic sewage. In the various reports of the last five years will be found the investigations giving the reasons for these conclusions.”

STRAWBOARD WASTE.

One of the most troublesome wastes to be found in the Middle West is that which is discharged from strawboard mills. It is a mixture of lime, finely divided cellulose, silica, organic extractives and water. As discharged from the mill it has a highly yellow color, due partly to the suspended matter and partly to dissolved coloring materials. It is only slightly if at all putrescible when kept in a container and has been kept in open vessels during continuously warm months without sustaining perceptible chemical or physical change. It is a highly turbid liquor containing about 4,000 parts per million of suspended solids. In the production of strawboard and strawboard waste the straw is cooked in rotary digesters with a strong solution of caustic lime water for about 10 hours. This treatment breaks up the fibre, removes the siliceous coat of the straw and destroys about 37 per cent. of the available board-making material, by reducing it to a very finely divided state. The pulp is then subjected to a process of beating which reduces it to a proper state for making board. From the beater it is run upon the cylinder machine, felted and dried. Strawboard waste consists of wash water from the beater and cylinders, each process furnishing about 50 per cent. of the total waste. A large part of this matter in suspension is cellulose, which has been reduced to so fine a state that it is washed out of the mass of pulp in the beaters and passes off in the waste water. It represents a dead loss in available cellulose. Only about 63 per cent. of the cellulose contents of the straw is recovered as finished product. The remainder of the suspended matter is composed of silica, derived from the outer sheath of the straw stalks, some undissolved lime, and a small amount of other materials. The liquor contains in solution a large proportion of certain lime salts, in organic combination a comparatively small amount of free lime, certain organic extractors and coloring matter, together with the ingredients originally present in the water. Of the suspended matter, 87.5 per cent. is organic, while the total organic nitrogen is only 2 per cent.

When this substance is discharged into a body of water containing sewage and other putrescible organic matter, it almost immediately becomes objectionable to the sight and smell, destroys fish, and imparts to the water a taste that can be detected in some cases more than a hundred miles down stream. Besides all this, strawboard waste is an excellent precipitant of sewage. Indeed it might be used with satisfaction in some chemical precipitation plants. In streams, however, it entangles all organic detritus which lodges in pools and eddies, silts up the stream and undergoes putrefaction. In this way the normal course of self-purification is prevented.

So far, all attempts to solve the strawboard waste problem have failed. Numerous methods of treatment, both mechanical and chemical, have been found to be either inefficient or prohibitive in expense. During the past year this subject has been investigated by the U. S. Geological Survey through its Division of Hydro-Economics and under the immediate supervision of Mr. Earle B. Phelps, Hydrographic Aid. By courtesy of Prof. W. T. Sedgwick the work is being performed in the Laboratory of Sanitary Research connected with the Massachusetts Institute of Technology. The results so far secured are of great interest as they throw light on several matters hitherto not well understood and explain in a measure the reasons why previous attempts to secure economical sedimentation of the suspended matters in strawboard waste have been unsuccessful. It appears that while the liquor usually contains from 1,000 to 1,200 parts of calcium per million, only about 10 per cent. of this is in the form of free lime, the remainder being combined with organic acids to form cumbersome calcium salts, which probably remain in colloidal form. As such they are changed to corresponding colloids upon the addition of the ordinary precipitants such as alum or ferrous sulphate and until all the calcium is displaced and an excess of the precipitant added there can be no coagulating effect, necessary to sedimentation of such suspended matters as are found in strawboard waste.

It has been found moreover that the part of the waste from the paper machines, equal roughly to 50 per cent. of the entire volume, is of a character quite different from that which comes from the beaters and should receive separate treatment. Simple filtration of the former will undoubtedly effect all the improvement desired and experiments have been arranged which will furnish data necessary for the intelligent management of filters erected for this purpose. The waste from the beaters, which contain 98 per cent. of the suspended matter, can then be treated at far less expense than the entire waste. Numerous experiments upon this part of the waste are being maintained and several promising lines of investigation looking toward the utilization of the by-products are being pursued.

A complete survey of the whole work makes it appear that the final solution of the great question of strawboard pollution will be an improved process of manufacture. It has already been stated that the industry loses about 37 per cent. of the available cellulose in straw by the present method of manufacture. Unlike many other wastes this one is largely made up of the principal product of the mills. Every damage resulting from the discharge of strawboard waste seems absolutely wanton, for it is caused by material which should have become finished

product. No intelligent investigation of this vital question will therefore be complete unless the major portion of attention is placed upon the improvement of the process of manufacture.

ACID IRON WASTES.

The polluting liquors from iron works, commonly designated as "Acid Iron Wastes" are derived from what is known as the pickling process, which is used in galvanizing, tube, tin plate, and sheet iron works and, in fact, all works in which a clean iron surface is required for coating or other purposes. The liquor is usually a fairly concentrated solution of ferrous sulphate or chloride with a small and varying percentage of free acid.

The principal evil effects of this waste are apparent first when it is turned into sewerage systems and thence finds its way into sewage disposal plants; second, when turned directly into streams.

It will be necessary merely to recall the work of Kinnicutt and Eddy at Worcester, Mass., in order to describe the effect of acid iron waste upon the septic tank. The same conclusions may, in a measure, be expected in the case of other kinds of disposal works in which the efficiency depends upon the reduction or oxidation of organic matter to inorganic.

An investigation recently maintained by the U. S. Geological Survey and the Ohio State Board of Health of the effect of the effluent from the tube works at Shelby, Ohio, upon the sewage disposal system of that city and upon Black Fork, a stream flowing past, into which the effluent is turned, showed conclusively the deleterious effects of the acid iron waste. Not only was the efficiency of the disposal process lowered, as was shown by comparative tests before and after the waste was turned in the system but the effluent emerges with a high content of ferrous iron salts which increase enormously its oxygen consuming capacity. The stream is in this way bereft of its free oxygen. The water becomes turbid, its normal hardness is increased and the difficulties of purification for water supply purposes are greatly increased.

It will be seen that the principal deleterious effect of this waste is the prevention of the normal course of biological changes in organic matter. The ferrous sulphate in this waste is a valuable product and can be readily isolated. The Shelby plant presents a good example of what may be accomplished. There the liquor is stored in a tank while the free acid is neutralized by the addition of iron filings, and is then evaporated until it has reached a degree of concentration sufficient to allow of the crystallization of the ferrous sulphate. It is then run into small tanks and crystallized and sold.

Although there is a recovery of only 22 per cent. of the available product at this plant there is an annual return of \$1,340, or about 53 per cent. of the capital invested, for recovery plant. With a better process and a consequently higher percentage of recovery, the profits would be proportionately greater. Therefore the pollution of streams by acid iron waste is quite unnecessary.

SODA PULP WASTE.

The hydrolytic treatment of wood chips at a high temperature in the presence of caustic soda produces a wood pulp and a soda liquor containing the lignone extractives mentioned in the discussion of sulphite pulp waste. In the case of soda pulp, however, the digester liquor is not turned into streams because it contains large quantities of soda which may be recovered with great profit. In this process of soda recovery the organic extractives of the wood are consumed in a furnace, the important wastes from a soda pulp mill consisting of the lime and charcoal which is derived from the soda recovery process.

The soda is recovered from the spent liquor in the form of a carbonate and is changed to a caustic solution by the application of quick lime, this leaves a lime carbonate as a residue which forms by far the greater proportion of the soda pulp waste. The charcoal which is formed in large quantities is the result of the ignition of the soda liquor in furnaces. The liquor as it is drawn from the digesters is evaporated and finally ignited in rotary furnaces, the ash containing little except sodium carbonate and carbon. The soda is then recovered by bleaching and the charcoal passed out as waste. The remaining important waste from a soda mill is the lime in the form of chloride and carbonate, that is, waste from the bleaching process. The amount of this is comparatively small.

It has been shown conclusively that simple sedimentation is sufficient to separate the suspended material from the waste which runs from a soda pulp mill. At present the lime is comparatively useless, but the charcoal may be economically used as a fuel. The effluent from such a sedimentation process is a highly alkaline liquor which contains comparatively large amounts of soda, lime and chlorine, it is a highly germicidal liquor and has been found to be an excellent agent of precipitation.

ACID MINE WASTES.

Considerable damage has been wrought upon water-supply interests by the discharge of wastes from coal mines. Though this waste

varies considerably in the different mining regions, it may be generally described as a highly acid liquor containing large amounts of lime, magnesium, iron and aluminum. Nearly all the metals found are in the form of sulphates and it is common to find a large proportion of free sulphuric acid.

When this waste is discharged into small streams it proves to be highly detrimental, killing fish as well as all vegetation with which it comes in contact. Such a stream cannot be used as a source of feed water for boilers, nor is it satisfactory for domestic use.

The mine waste is not always deleterious. When it is discharged into streams containing large amounts of sewage, its effects are clearly beneficial. Two notable cases deserve mention at this point. The first is that of the Susquehanna River along what is known as the Wyoming Valley at the western edge of the northern coal measures of Pennsylvania. At the point where the Susquehanna enters the coal measures a short distance above Pittston, Pennsylvania, the water has a fairly good character, as might be expected of any stream draining a farming country in which there are only a few centers of pollution. Shortly after it enters the coal measures it is joined by Lackawanna River which contains the sewage from Scranton, Carbondale, and other places. In a short distance below the mouth of Lackawanna River, the Susquehanna receives the sewage from the cities of Pittston, West Pittston, Wilkesbarre, Kingston, Plymouth, and Nanticoke. Thus in a distance of about 12 miles the river is burdened with the sewage of about 225,000 people. In addition to this many thousands of tons of fine culm are poured into it. Along this same section, there is also an enormous amount of mine drainage, amounting in seasons of low water to about one-fifth the total flow of the river. So pronounced is the effect of this mine waste that the river water is better from a standpoint of organic content when it passes out of the coal measures below Nanticoke, than when it entered the coal measures above Pittston. Another stream on which mine waste exerts a beneficial influence is the Potomac. As a result of the working of the coal mines in the Potomac Basin in West Virginia, large amounts of acid mine waste are discharged into George's Creek and enter the North Branch of the Potomac at Piedmont. On the North Branch just above Piedmont is a large soda pulp mill from which are discharged upwards of 15,000,000 pounds of lime annually. The result of the mixture of these two liquors, the mine waste containing large quantities of ferrous sulphate and free sulphuric acid and the lime water from the mill — is that which may be expected to follow in all cases of artificial treatment with lime and iron. The impurities in the stream appear to be depos-

ited by the time the water reaches the intake of the Cumberland City waterworks, a few miles below, as at that point it is clear, quite colorless and apparently of good domestic quality. These two instances apparently demonstrate that there are certain industrial wastes which may prove beneficial to the surrounding country.

There are polluting industrial wastes other than those briefly described above which are frequently of importance. Their character as a whole is somewhat similar to those already discussed, and they will be omitted from consideration here.

SUMMARY.

Industrial wastes have very important and usually deleterious effects upon the water supply values. For whatever purpose water is used its contamination by industrial wastes nearly always renders it less valuable. All but a few of trades wastes exert a bad effect upon water supplies. This makes them important from a sanitary standpoint, and therefore places them within the legitimate field of investigation by boards of health, and other sanitary authorities. Until the whole range of industrial wastes has been studied and efficient and economical methods of disposal and recovery are provided, the streams of this country will never be free from serious contamination. Even though knowledge of sewage disposal becomes perfect and sanitary disposal works are provided for every municipality, the ultimate object will not have been attained.

In studying trades wastes attention should be given to a very important question of the attitude of the investigator to the manufacturer. It is incumbent upon the health authorities to advise methods of disposal which shall be unquestionably efficient. No sanitary authority will be wise if it ventures to order or to enforce the abatement of any nuisance unless that authority shall first be prepared to intelligently demonstrate that it can be done. If health authorities order a manufacturer to stop polluting a stream with the waste from his plant, and in reply to this question, "How shall I do it?" are obliged to say, "We do not know," their case becomes very weak, their prestige is gone, and in the majority of cases, the manufacturer will defeat them in the courts. Justice very properly protects an individual from unreasonable requirements, and a demand is clearly unreasonable if the person making it cannot comply with it or indicate a course of procedure. Having set out to provide a method of disposal in this assumed case, shall attention be given to the mere question of innocuous disposal in order to escape the consequences of river pollution; or shall there be taken into account the valuable ingredients of that waste and endeavor

be made to provide means whereby the process may pay for itself, or be a source of profit. The choice of these methods will in the end depend upon which will accomplish the most.

While the purpose of the sanitarian is to secure the disposal of waste material in such a final form that it will not be deleterious to health rather than to discover methods of pecuniary benefit to the manufacturer who is discharging waste and doing damage, his policy should be nevertheless expedient. On the one hand there is the manufacturer whose interests are purely commercial, who believes that streams are the legitimate places of waste disposal, and who will stoutly and consistently oppose all expenditures which increase the cost of his product, for the mere purpose (what he considers the *mere* purpose) of purifying streams. On the other hand, there is a body of sanitarians whose purposes are not commercial but exclusively humane. Unfortunately, commercial practices are generally at issue with humane practices; they do not meet on common ground. However much the predominance of the commercial spirit may be deplored, its potency must be recognized. Industrial interests will finally control; there is no escape from this conclusion; therefore the manufacturer should not be antagonized unnecessarily, but streams should be purified by his help. It is more praiseworthy and useful to make a dangerous trades waste a source of profit than it is to antagonize the predominating force in modern society, or as a forlorn resort to close a manufacturer's plant.

DISPOSITION OF MUNICIPAL REFUSE.

AMERICAN CONDITIONS ILLUSTRATED BY DATA FROM REPRESENTATIVE CITIES.

BY W. F. MORSE, SANITARY ENGINEER, NEW YORK CITY.

I. PRESENT CONDITIONS OF AMERICAN WASTE DISPOSAL.

The Times, of London, England, March 5, 1905, makes this observation on American waste disposal methods:

"Whilst the refuse-destructor has attained a recognized position in this country, and its value is acknowledged on all hands from an economical as well as a hygienic point of view, the situation regarding similar appliances in the United States is in singular contrast to the progress made in this country in the utilization of towns' refuse. The chief of the causes assigned for the backwardness in this respect is concerned with the politics of the United States municipalities, by which municipal engineering and sanitation are controlled to a large extent by considerations which have no reference to their individual advancement and well-being. Contracts relating to such engineering works are found extremely difficult to obtain on any satisfactory basis, and still more difficult to successfully carry out, with the result, as stated, that an important branch of engineering practice in the United States is, and seems likely to remain, many years behind that of Europe."

The above statement, from such a source, is an indictment of the prevailing practice and methods in waste disposal in America that cannot be ignored.

It is, in effect, a charge that municipal authorities have allowed the considerations of party politics, the deals and "swaps" of personal influence, the pressure of selfishly interested parties, and the veiled or direct offers of contingent financial advantage to govern their action in regard to the matter. This evil extends much further when the city fathers grant a long-term contract or franchise at high rates of payment, developing into a monopoly holding on to the franchise with a grip almost impossible to dislodge later on.

These facts are only too well known to American engineers, and the discouraging results attending disposal work for twenty years past give good grounds for such charges as come to us from outside observers.

For eighteen years the subject of waste disposal has been under examination and discussion by this Association. The papers, addresses and debates published in its transactions have dealt with its various phases as they have developed in the single instances of cities and towns, showing the slow, imperfect development of the art under many adverse conditions, and the application of many varied forms, methods and apparatus.

These papers and discussions evidence a sincere effort to obtain the best means of disposal, but in the main it must be candidly confessed that the expectations and hopes which have been raised have not as yet been fully realized. Some later papers presented here have given a great deal of information in regard to existing conditions, and pointed out the necessity for improved methods, but they have not clearly indicated exactly what course should be pursued in order to better the conditions.

In other associations, such as the League of American Municipalities, the American Society of Municipal Improvements, and the Civil and Mechanical Engineering societies, this subject has been written about and debated upon with the help of some of the highest engineering experts and authorities from abroad, whose reports, though not conclusive as to the means that should be adopted, have been of service for information in regard to the general questions involved.

The whole question of economical and efficient methods of municipal waste disposal is just at this time in a changing, unsettled state; the tendency is consequently to "go slow" and not to commit the city to the adoption of schemes and plans that have not been thoroughly tested by practical use or that cannot be recommended by the endorsement of those competent to report upon the particular conditions governing each individual case. But the subject is now being seriously taken up by universities and colleges, special engineering training being given along the lines of the scientific disposal of city waste, and we shall soon have a large corps of young men thoroughly grounded in the best methods used here and abroad, whose services in this line will hereafter be invaluable to the municipalities.

Sanitary waste disposal affects the pocket-book as well as the health of the public, and deserves and should command the same attention and expenditure of money to bring it to a successful issue that is considered necessary in every other department of city administration. In four or five instances where the question has been approached from the side of economy and efficiency in service, and where, with the aid of expert knowledge, modern disposal plants have been installed, there have been marked advances over former unsatisfactory methods and

results, and the benefits enjoyed have been creditable alike to the city and to those connected with the work.

It may not be out of place to note a few points connected with this work, the result of observations extending over some years of practical experience and investigation of the subject, and these points are offered as suggestions for future investigations and reports.

1. — An intelligent study of local conditions is absolutely necessary. A clear idea of the class and character of waste to be dealt with should be obtained, and the vague statements of cartloads usually submitted must be reduced to some known standard of measurement, such as cubic yards or tons, and the information tabulated for future use.

2. — It should be decided which method or system will give the most efficient service. The knowledge obtained by the intelligent study of local conditions will largely guide in selecting the best means of disposal. It should be borne in mind that no two communities are exactly alike, and that a method which may be perfectly safe and efficient in one town may be quite unfit for another.

If this question cannot be easily settled, some one with training and experience, whose judgment and reports can be relied upon, should be called in to examine the situation and make recommendations. The whole question is assuming a place in municipal affairs which demands skilled and scientific treatment and more direct responsibility.

3. — The means of disposal having been selected, the municipality should draw up its own specifications, stating clearly exactly what is wanted, and the conditions for tenders. All theoretical and "on paper" plans should be eliminated. Three hundred and twenty-five patents for waste disposal have been issued in the United States, and every man who has obtained one apparently thinks himself entitled to have its value demonstrated at the expense of his fellow townsmen. This is the chief reason why years of time and great sums of money have been spent on worthless, insanitary schemes. In the work of waste disposal, as in commercial enterprises, it should be emphatically "the survival of the fittest."

4. — When a method or system is completed it is entitled to a fair trial. To pre-judge the whole and to prejudice the community is unfair and unwise; but should the conditions of the contract not be fulfilled there should be no palliation of the failure, and the rights of the city, for its own protection and that of other places, should be rigorously insisted upon.

5. — There should be instituted and maintained a systematic oversight of the methods in use, the returns, good or bad, being tabulated

for public information and for the help of other communities. The annual reports of the sanitary officers and inspectors at the meetings of the British sanitary and municipal associations are of immense service, as they contain definite results of disposal methods which help to guard others from error and facilitate the introduction of means and apparatus known to have stood the test of actual use.

With the use by engineering skill of the data which may be collected by the means indicated there can be no doubt of the attainment of good results. Now we know what not to do; the future should show us what to do, and how to do it.

II. THE DISPOSAL OF MUNICIPAL RUBBISH.

There is one phase or sub-division of waste collection which has been more carefully examined within the past three or four years than formerly, the reported results of which will be of interest and service. This is the collection, treatment and final disposition of rubbish or light refuse, or that part of municipal waste which is neither garbage, ashes nor street sweepings.

In three large American cities this work has been carried on by the use of special apparatus which receives all the rubbish, recovers the saleable portions and destroys the worthless residue, utilizing for various purposes the heat derived from its combustion.

As a basis for computing the relative quantities of city waste products the following table has been carefully compiled from the latest reports and returns:

TOTAL QUANTITIES, GARBAGE, ASHES AND RUBBISH PER ANNUM IN FOUR CITIES.

	Total Amount collected per annum.		Quantities per 1,000 Population.			Amount per capita per annum in lbs.
	Loads.	Tons.	Population.	Loads.	Tons.	
New York: Boroughs of Manhattan and Bronx....	1,798,747	1,656,812	2,530,000	710	654	1,313
Boston	392,422	329,059	530,000	740	620	1,241
Buffalo	59,374	204,861	373,000	159	548	1,098
Brooklyn	589,477	330,870	1,394,000	423	238	477

Beginning with these figures as representing the total quantities, and considering separately the only places, where the rubbish has in past been separately collected and disposed of, a review of the work done in these cities will afford a good idea of the quantities to be handled and the methods of dealing with them applicable to other cities in a like situation.

NEW YORK CITY.

TABLE SHOWING APPROXIMATE RELATIVE QUANTITIES, BY VOLUME AND WEIGHT, FOR EACH 1,000 PERSONS PER ANNUM, IN THE BOROUGHES OF MANHATTAN AND THE BRONX.

	By Volume.		By Weight.		By 1,000 Population.			Weights. lbs.	
	Loads.	Per cent.	Tons.	Per cent.	Loads.	Tons.	Per capita, lbs.	Loads.	Cubic yards.
Garbage ..	224,248	12.8	201,335	12.1	88	79	159	1,800	1,200
Ashes ...	1,336,456	74.2	1,336,456	80.7	528	528	1,060	2,000	1,500
Rubbish ..	238,043	13.0	119,021	7.2	94	47	94	1,000	155
Totals..	1,788,747	100.0	1,656,812	100.0	710	654	1,313	.....	.....

New York City was the first to experiment with this matter, as Col. Geo. E. Waring, when commissioner of street cleaning, built a small disposal station that received the rubbish from three districts containing a population of 116,000, and continued this for two and one-half years. The station was built by the city and operated under contract through competition, the revenue to the city being at the rates of 59 cents, 61 cents and \$1.10 per ton for the three years.

In respect of the recovery of valuable material that had previously been wasted it was a successful experiment, but upon the incoming of a new city administration the station was abandoned and the rubbish turned over to a favored contractor who, in the course of the four following years, derived large returns from it for the benefit of those interested. Subsequently, Dr. Woodbury, the present commissioner, caused to be built on a pier at West 47th Street a similar disposal station, which after numerous changes and alterations is now doing creditable work. The cost of this plant was approximately \$25,000. It

includes a steel building containing an incinerator with three connecting cells, fed by hand, a conveyor for the separation of the rubbish, and steam boilers for utilizing the heat derived from combustion.

A clear idea of the results attained can be had from the following epitome of the report kindly furnished me in advance by the commissioner. In this, the trials or tests made October 7, 1904, for one-half day, are taken as a standard of measurement for quantities and steam power, and furnish data for the amounts of rubbish when taken in conjunction with the reports from the 30th Street dumps, where the rubbish is also sorted but the residue disposed of in the old manner by dumping.

REPORT OF OPERATION OF 47TH STREET RUBBISH DISPOSAL STATION.

COLLECTION. Quantities Received.			QUANTITIES RECEIVED AND DISPOSED OF, AND STEAM POWER DEVELOPED. Separated by Classes, Pounds.									DISPOSITION. Quantities Burned in Pounds.		
Loads.	Cubic Yards.	Weight Pounds.	Paper.	Cardboard.	Rags.	Other Saleable Articles.	Non-combustible (Iron and Glass.)	Combustible, Wood.	Total Pounds.	Per cent.	Wood.	Paper.	Per cent.	
54	334½	52,630	9,047	4,909	1,007	1,656	2,305	4,220	23,150	48.8	6,394	17,881	51.2	

Total picked out, 23,114 lbs.; 48.8 per cent. by weight 63.5 per cent by volume.
Total burned 24,275 lbs.; 51.2 per cent. by weight, 36.5 per cent. by volume.
Total ashes from combustion, 3,529 lbs. = 6.8 cubic yards, at 519 lbs. per yard.
Percentage of ashes of amount burned, 10.7 by weight, 3.1 by volume.

STEAM POWER DEVELOPED.

Tests of Boiler Power, Average of Three Trials, 2, 3 and 4 Hours, for One Day.

Mean temperature of feed water.....	50° F.
Steam pressure per square inch.....	80 lbs.
Quantity of fuel burned, wood and paper.....	12,384 lbs.
Quantity of water evaporated at 212° F.....	21,843 lbs.
Horse power per hour	190.0 H.P.
Evaporation per pounds of refuse from and at 212° F.....	1.66 lbs.
Horse power per square foot of grate (104 square feet area).....	1.24
Horse power per cubic yard of rubbish burned.....	4.93 H.P.
Power developed in excess of demand	200 H.P.

FINANCIAL STATEMENT.

INCOME.		EXPENSES.	
By saving on former method of disposal per week.....	\$210 00	To cost of labor.....	\$127 19
By electric light utilized per week	4 00	Supplies, etc., and interest on plant	38 46
	<u>\$214 00</u>		<u>\$165 65</u>
Net income per week.....			\$48 35
Total return per annum			2,514 20
Value of steam power not utilized.....			8,000 00

This report gives no value of the sorted rubbish, which is placed by the commissioner at \$3.20 per ton paid by the contractor for the privilege of sorting.

By tabulating this report and adding to it the data from the 30th Street station, a clear idea of possible results may be realized.

QUANTITIES AND PERCENTAGE OF RUBBISH RECEIVED AND DISPOSED OF AT 47TH STREET AND 30TH STREET STATIONS, EXTENDED TO ONE YEAR OF 300 DAYS.

	Collection.			To be Picked 48.8 per cent.		To be Burned and Dumped 51.2 per cent.	
	Loads of 6.9 Cubic Yards.	Cubic Yards of 155 lbs.	Tons.	Cubic Yards.	Tons.	Cubic Yards.	Tons.
One Year	38,850	268,065	19,425	130,816	9,479	137,249	9,946

If the total annual collection of rubbish in these boroughs were treated in a similar way the figures would rise to large proportions. There are 119,021 tons; deducting from this 10 per cent. for contingencies leaves 107,119 tons, of which 48.8 per cent. is picked out, leaving 51,410 tons available for market. On the basis of \$3.20 per ton, as above, this represents a total of \$164,076 as the market value of the recovered material. If to this be added the present cost for transportation the total saving by establishing this method in all the city would approximate \$200,000, without taking into account the value of the steam power to be developed.

BOSTON.

The approximate quantities of waste annually collected in Boston and the relative amounts per 1,000 of population are shown in the following table:

	Total Collections.					Disposition (Loads).					Per 1,000 of Population.	
	Loads.	Per cent.	Tons.	Per cent.	Delivered to Reduction Company.	Taken by Contractors.	Dumped at Sea and Land.	Delivered to Refuse Plant.	Tons.	Per cent.	Loads.	Tons.
Garbage	64,744	16.5	80,929	24.6	49,219	15,525					122	152
Ashes	289,933	73.8	232,881	70.8			289,933				545	439
Rubbish	37,746	9.7	15,249	4.6			21,871	15,875	7,427	48	73	29
Totals	392,423	100.0	329,059	100.0	49,219	15,525	311,804	15,875	7,427	48	740	620

The rubbish of the city of Boston was formerly disposed of by dumping at sea, giving rise to nuisance on adjoining beaches. The movement for better conditions made by the City Board of Health in 1896-97 led to action by the city in 1898-99, at which time a contract was awarded to a private company formed for the purpose of disposing of the rubbish for a period of ten years, the city reserving the right to purchase the plant. A description of this plant and the results anticipated at the time of its completion were given in a paper at the meeting of this Association in Minneapolis in 1899, and it is only necessary to briefly refer to it here.

The building is on Atlantic Avenue, in the heart of the city. It is of brick, 200 feet by 70 feet, and contains a picking belt or conveyor for sorting the rubbish into the various classes, power presses, and a destructor for burning the worthless parts. The heat from the destructor operates the steam boiler, supplying power for lighting and heating the plant and operating the machinery.

The rubbish is collected daily from business, manufacturing and residential portions of the city, a district containing approximately 200,000 persons and ninety miles of streets, by seventeen large wagons

and thirty-one paper carts, and includes every form of waste except garbage, ashes and street sweepings.

The amounts separately collected in the last five years and the relative amounts utilized are as follows:

Yearly average number of loads, 17,646, weighing 996 pounds each; delivered at station 16,447 loads, approximately 8,053 tons.

This collected amount is about 48 per cent. of the total quantity produced in the city; the balance, 8,724 tons, or 52 per cent., being dumped with the ashes on low ground. The separated portions are approximately 47 per cent. by weight, and 63 per cent. by bulk, and are saleable at current market rates.

The city receives the greater benefit from this system of disposal, as the delivery at this station is less costly than at any other point, and the sanitary disposition is a great advantage over the former methods with their attendant nuisances and consequent complaints.

BUFFALO.

The official reports of Col. F. G. Ward, Commissioner of Public Works, and Mr. C. M. Morse, Deputy Engineer Commissioner, contain the figures for the Buffalo garbage and waste collection and disposal for the year ending June 1, 1904. During the first two months of July and August the work was done by the city, but the new contract with the Buffalo Sanitary Company for the collection and disposal of all the ashes, refuse and garbage came into effect in September, 1903. One condition of this was the erection of a refuse disposal station on city ground in conjunction with the sewage pumping station. The heat from the destructor is to be utilized by the boilers of the sewage plant. The plans and designs presented by the speaker were accepted for the installation of the refuse disposal station, and the plant was completed and began work in May, 1905.

The building is 200 feet long, 50 feet wide, and 25 feet high, with brick walls and steel trussed roof. The rubbish is collected in large carts holding fourteen cubic yards, and is dumped on the floor, where, after roughly sorting out the bulky and incombustible matter, it is placed on a conveyor or picking belt and carried up an incline to the sorting floor, passing for a length of fifty feet between bins or picking boxes, into which the several varieties of paper, cardboard, rags, glass, leather and rubbish are picked or sorted out. The remaining portions, comprising small bits of paper, wooden berry boxes, excelsior, straw and other combustible material is carried on by the conveyor up another incline, and passed through chutes into the charging holes of the

destructor. When the conveyor is running the stream of combustibles is constant, and no hand-feeding is required.

The furnace, of special design, is 35 feet long, 12 feet wide and 13 feet high, with exterior doors for stoking and removing ashes. The interior is provided with a system of double fire-brick parallel grates of large capacity, the combustion being assisted by a forced draft of air from a blower under the front ash-pits. During the first four months before the sewage plant was ready for work, a 60-hp. vertical boiler was used for the operation of the refuse plant, driving the conveyor and baling presses and operating a dynamo for lighting purposes. There are three steel power presses for baling the waste. The whole construction is of the best material; steel and concrete being used instead of wood and making the plant fireproof throughout. The chimney, built of radial bricks, is 125 feet high, and five feet in diameter, and is connected with the steam boiler of the sewage plant.

QUANTITIES, COLLECTION AND DISPOSITION OF GARBAGE, ASHES AND RUBBISH AT
BUFFALO, N. Y., FOR 1904.

	Collection						Disposition.				Per 1,000 of Popula- tion.	
	Loads.	Per cent.	Cubic Yards.	Per cent.	Tons.	Per cent.	Delivered to Reduc- tion Co. Tons.	Tipped on Land. Tons.	Delivered at Station for Two Months.		Cubic Yards.	Tons.
									Cubic Yards.	Tons.		
Garbage ...	6,888	11	30,000	7	21,029	10.2	21,029				80	56
Ashes	37,515	63	222,513	55	166,885	81.5		166,885			597	447
Rubbish ...	15,474	26	157,653	38	16,947	8.3		14,086	27,325	2,937	422	45
Total	59,377	100	410,166	100	204,861	100.0	21,029	180,971	27,325	2,937	1,099	548

The delivery of the rubbish at the utilization station is made by large carts holding fourteen cubic yards, and these are unloaded in the average time of twelve to fifteen minutes by an ingenious device, operated by power.

The weight of rubbish in Buffalo is considerably more per cubic yard than it is in other cities, and a large proportion of dust and worthless matter is collected which has afterwards to be removed.

QUANTITIES OF RUBBISH COLLECTED AND DISPOSED OF IN BUFFALO DURING JUNE AND JULY, 1905.

Collection.				Disposition.			
Cubic Yards.	Removed before Treatment.	Per cent.	Net Amt. Handled Cubic Yards.	Picked Cubic Yards.	Per cent.	Burned Cubic Yards.	Per cent.
27,325	1,337	21	25,998	11,399	40	15,598	60

No report of the amount of steam power is obtainable at present, as the sewage plant is not yet ready for operation, but here, as in Boston, a 60-hp. boiler furnishes power for all the needs of the station, including electric lights, and there is a surplus of 30-hp. unused.

BROOKLYN.

Rubbish disposal in this city is effected by a company having the contract for collection and removal for five years. The ashes and waste, separately collected by the city, are delivered at thirteen stations in various parts of the city and the paper refuse is roughly picked out, the residue being taken by trolley to low ground at Sheephead. One station has a small incinerator which destroys the worthless parts, and additional small furnaces may be built. The city pays the company 39 cents per cubic yard for this disposal. No accurate record of quantities sorted out or destroyed can be obtained, but in general the quantities of waste as reported by the street cleaning department are as follows:

	Collection.						1,000 of Population per Annum. Weights lbs.				
	Loads.	Per cent.	Cubic Yards.	Per cent.	Tons.	Per cent.	Cubic Yards.	Tons.	Lbs.	Loads.	Cubic Yards.
Garbage	90,330	15.3	135,495	14.5	81,297	24.6	97	58	117	1,800	1,200
Ashes	402,417	68.2	603,625	62.	201,208	60.8	433	144	288	2,000	1,500
Rubbish	96,730	16.5	225,825	23.5	48,365	14.6	162	35	72	1,000	155
Total	589,477	100.0	964,945	100.0	330,870	100.0	692	237	477		

NOTE. — The rubbish is rated and paid for by the city at $2\frac{1}{2}$ cubic yards per load (or 400 lbs., which is about 40 per cent. of the whole load) at 39 cents per cubic yard. The reports of collections show the volume of a load to be $6\frac{1}{2}$ cubic yards, weighing 1,000 lbs., and this has been taken as the basis for computing the total amounts. The difference may be taken to represent the percentage of rubbish not saleable.

The reports of quantities, etc., in these four cities have been separated from the general reports, to give some idea of relative proportions and classes. It is a matter of great difficulty to give accurate figures, and some surprising and perplexing comparisons can be made, illustrating what has been before said — that each city and town has its own special conditions, which must be studied carefully to arrive at any sure conclusion. It is hoped that these statistics may lead to investigations in this line at other places.

The conclusions to be drawn from the reported results of the application of modern methods of rubbish disposal in these cities may be thus briefly stated:

There is in every large city a proportion of rubbish, averaging 10 per cent. of the total municipal waste, that can be separated from the general mass by the householder and delivered to the city collection carts in a comparatively clean condition.

This rubbish can be more rapidly and economically collected from a wider extent of streets than can ashes or garbage.

It can be treated at almost any point within the city limits without nuisance or offense to adjoining property-holders, thus insuring short haulage.

The recovery of the saleable parts will afford a revenue, and if carried on by the city will earn it dividends of considerable magnitude.

This method of disposition does away with the complaints that arise from the practice of dumping at sea or on land, and as it is perfectly sanitary in operation it cannot itself cause complaints of a similar nature.

Disposal by properly constructed furnaces will develop steam power for municipal use or for sale to private parties.

The system of separate rubbish collection and disposal assists the collection and disposal of the other city wastes by removing a great bulk of refuse otherwise interfering with the successful treatment of garbage and ashes.

THE POLLUTION OF OYSTERS.

By GEORGE A. SOPER, PH. D., NEW YORK.

MEMBER N. Y. BAY POLLUTION COMMISSION.

Early in the work of the New York Bay Pollution Commission, which was appointed in 1903 by the Governor of New York State to inquire whether the unrestricted emptying of sewage into the waters of New York Bay was likely to bring about conditions injurious to public health, it was found that parts of the bay were extensively used for oyster culture. Studies were at once undertaken to determine whether the cultivating and handling of oysters under these conditions were attended with danger to the consumers of the shellfish.* The investigation thus begun grew rapidly as time progressed. It extended to other oyster producing centers than those in this immediate vicinity until a large part of the Atlantic coast was included in the inquiry.

In the fall of 1904, an unusual opportunity was afforded the author to study the details of this subject when he was called upon to investigate a sporadic outbreak of typhoid fever at Lawrence, N. Y., due to oysters.†

Upon being requested to present to the Association the results of his study of the subject of the pollution of oysters, a paper was prepared and read at the Boston meeting. This paper appears too long for the Transactions and as much of its material will be made available for the members of the Association in another form, only the conclusions will be here given.

CONCLUSIONS.

1. *Proof that typhoid may be transmitted by oysters.*—The evidence that typhoid may be contracted from eating raw oysters is as positive as anything in the etiology of this disease. It depends upon (a) careful investigations of many sporadic and epidemic outbreaks of typhoid; (b) a large number of bacteriological experiments made in the laboratory and in the field, and (c) extensive sanitary inspections of the conditions under which oysters are grown and prepared for market.

* Report of the New York Bay Pollution Commission to Hon. Frank Wayland Higgins, Governor, Albany, N. Y., March 31, 1905.

† Report of a sporadic outbreak of typhoid fever at Lawrence, N. Y. due to oysters, in Medical News, N. Y., February 11, 1905.

The amount of typhoid which is caused by oysters is probably smaller than the amount caused by water and milk, although the consumption of oysters from sewage polluted water is by no means uncommon.

2. *Extent and value of the oyster industry.* — The oyster industry of the United States is enormous. It extends from Massachusetts Bay south along the whole Atlantic coast and is of growing importance in California.

The number of bushels of market oysters produced in the United State annually, as near as can be ascertained from bulletins issued by the Bureau of Fisheries of the Department of Commerce and Labor, is 25,830,261, valued at \$13,635,528. This is approximately seventy per cent. of the total oyster production of the world.

From data obtained from many sources as to the wages earned and the persons employed in various ways in different sections, and keeping in mind the fact that although the production of oysters has increased rapidly in recent years, the methods of dredging and planting has tended to reduce the number of hands, it seems reasonably certain that the number of families supported in one way or another by this business cannot be less than fifty thousand. It may be much greater.

3. *Infection of oysters at their beds.* — To reduce the delays and cost of transportation, oysters are often grown dangerously close to their shipping centers and markets. This means the frequent location of beds in harbors, bays and river estuaries, which in some cases receive the sewage of cities containing hundreds of thousands of people.

4. *Infection of oysters during storage in water.* — In some instances, oysters which are caught at a considerable distance from their point of shipment or sale are stored in harbors within dangerous proximity to wharves, dwellings and sewers. This danger was well illustrated in the typhoid outbreak near Lawrence, N. Y., where floats containing several thousand bushels of oysters were kept within a few hundred feet of the outfall of a badly managed sewage disposal plant.

5. *Infection during the process of "drinking."* — The most prevalent cause of oyster pollution lies in the custom of preparing oysters for market by immersing them for some hours in fresh or brackish water after they are taken from the beds and usually before they are opened. This process is called "drinking." Its object is to improve the market value of the oysters by increasing their appearance of whiteness and bulk and adding to their keeping qualities while in the shell. By "drinking," five quarts of moderately lean oysters can be swollen to the bulk of six quarts. Most oystermen appear honestly to believe that this is in reality a fattening process, but Prof. Atwater, who has investigated

the subject, declares that it is one of osmosis, or dialysis, and that the nutritive value of the oyster is actually reduced by it.

From a sanitary standpoint, oyster drinking is objectionable from the fact that some of the streams where the oysters are thus treated are seriously polluted. Some of the most extensively used drinking grounds which have been visited by the author are, in effect, little less than sewers. Extensive arrangements are sometimes made at these places for treating whole cargoes of oysters on their way to market from beds which are beyond suspicion of impurity. Ten or more vessels may occasionally be seen in the mouth of the Rahway River and at Port Richmond, N. Y., lying alongside of these "drinking" floats waiting for their cargoes of oysters to "drink." The process is usually completed in one ebb tide.

6. *Infection from careless habits of oystermen.* — The danger that any lot of oysters may be infected does not lie exclusively in the chance that they have been taken from water heavily polluted with refuse from sewers. A single privy or drain near oyster beds or floats or the careless and uncleanly habits of some oystermen constitute an especially common source of danger. As with drinking water, experience shows that pollution is always to be especially apprehended at short range.

7. *Infection during opening.* — Oysters have been known to be polluted in the opening. Oysters should never be dipped into a pail or tub of water during or after opening, unless the water is kept constantly renewed by a stream from a faucet. It is much better to do away with the tub altogether, using, when necessary, a jet of running water to wash small bits of shell, mud and sea-weed from the shell and hands. If the oyster is first cleaned and then opened properly, it will not need to be washed afterward.

8. *Inability of consumers to judge of the purity of oysters.* — There is no certain way for the consumer to tell whether oysters which are placed before him at the table are, or are not, the bearers of typhoid germs. Neither the health nor soundness of the oysters infested with typhoid bacilli is in any way destroyed. The bacilli exist in the juice and stomach and particularly the gills; sometimes on the outside of the shells. They cannot with certainty be washed away or mechanically removed in preparing them for the table. Nothing in the way of condiments which can be applied to the oyster at the table will destroy its infectious character if it is infected at all. The author has seen a case of typhoid caused by oysters eaten in an oyster cocktail. Thorough cooking alone will sterilize them. A superficial scalding or a moderate amount of heat applied in any way will not suffice. When

typhoid infested oysters are kept ten days out of water most of the germs disappear, but not all.

It is not possible to learn anything of the purity of the oyster from the appearance of the shell, as many suppose. The peculiarities of the shell are capable of indicating whether the oyster has been taken from shallow or deep water, a hard or muddy bottom and other facts which are interesting to the oyster culturist, but it is impossible for the consumer to tell by the appearance of the shell whether the oyster has been exposed to sewage pollution. In most cases, salt oysters are safer than fresh oysters.

Oysters should be shipped as direct as possible from their beds to their points of consumption. It is often impossible, however, to know whether they have come direct or have been stored or subjected to "drinking" on the way.

9. *Means by which health authorities can regulate the purity of oysters.*—The proper authorities to control the purity of shellfish appear to the author to be the National Government or State and local boards of health in co-operation with the various commissions already charged with the supervision of the shellfish industries.

In some cases, it may be necessary to enact new laws and ordinances, but in most cases it would appear that there is already sufficient law to bring about improvement. The sale of oysters which have been "drunked" in polluted water and are consequently unfit for food, should not be permitted. The lease by the State of oyster grounds known to be polluted should be discontinued.

The location of every bed and other source of oysters should be ascertained by the authorities and no grounds should be permitted to be used which are unfit, in a sanitary sense, for oyster culture. To carry out this plan, it may be necessary in some instances to require the rearrangement of the outlets of sewers, the construction of sewage purification works or, on the other hand, the removal of the oyster beds, storage floats and "drinking" places. The needs of each situation can be determined only by careful investigation.

10. *Sanitary protection needed by the oystermen.*—The most effective protection which the oystermen can have against the distrust which from time to time paralyzes their business is a more enterprising and sanitary conduct of their industry. It would be well if the reform should be started by the oystermen themselves. Efforts toward the establishment of public confidence should not be based, as was once attempted, upon a system of certificates of purity issued by a board of health or shellfish commission. The oystermen should see to it that

their shellfish are grown and handled in a safe and sanitary manner. It should be the effort of every oyster dealer to have his name more closely associated with his produce as a guarantee of purity. We hear too little of the names of oyster dealers and producers.

11. *Value of sanitary inspections and analyses.* — There should be little difficulty for a board of health to determine what oysters are, and what are not, safe, providing their history can be ascertained. Public officials are in a much better position to obtain these facts than private consumers. Oysters taken from water which, aside from its salt, would be too impure for drinking purposes, are not safe to eat.

In determining the quality of the water, there are available a large number of analytical methods which have long been used to determine the purity of drinking water supplies. Some of these methods are susceptible of application to the testing of shellfish, the bacteriological examination of which has been carried on extensively enough at the present time in England and America to indicate its value.

It is believed that the examination of shellfish for sewage bacteria is a useful procedure in those cases where a complete history of the shellfish and their environment is not available and where a sanitary inspection of the conditions of production fails to establish proof of the presence or absence of sewage contamination. The author is in accord with Profs. Brown and McWeeny, who consider that a sanitary inspection is in a large majority of cases enough to determine whether the oysters are, or are not, grown under dangerous conditions.

12. *Duties of physicians and others.* — Finally, it is the duty of every person, whether physician or not, to examine for himself the merits of this subject, and, if convinced of the need of sanitary reform, to communicate his ideas to others. It is the special duty of every doctor who practices where oysters are produced or eaten to see to it that an investigation and report is made of the cause of every case of typhoid fever which falls under his notice. Physicians in oyster producing centers should make a particular effort to be certain that the infectious nature of the stools, urine and other discharges of their typhoid patients, as well as the wash water, are destroyed before being thrown out.

SANITARY INSPECTION VERSUS SANITARY ANALYSIS.*

By R. B. DOLE, U. S. GEOLOGICAL SURVEY.

The sanitary examination of water has received much attention during the past 30 years in reports, periodicals, text-books, and lectures. Concerning it more literature is extant than on almost any other public health problem. The water question is comparable with an obscure and resistant disease for which, when no certain remedy is indicated, it is invariably the case that a multitude of medicines will be in the market, each warranted to effect a cure; in a similar manner we find all ranges of opinion and process in studying the potability of water. Possibly no such masses of analytical data with so little practical value have been accumulated in any other field of chemical research. The object of the present paper will have been accomplished if it succeeds in showing the advisability of diverting part of this intensified interest from analytical procedures to the hygienic survey of regions where water problems are being considered.

In 1867 Wanklyn (1) submitted the so-called albuminoid ammonia process for the determination of organic matter in water. Fixed standards of purity were considered. Limits for free and albuminoid ammonia, nitrites, and nitrates were given, above which water was considered dangerous. It was soon found that many waters of undoubted excellence were condemned by these standards which consequently required adjustment. Natural waters were then grouped as rivers, lakes, shallow wells, deep wells, or springs and bounds were established for the organic content of each class. These limits in turn succumbed to the definite knowledge that standards of purity in England would not fit the waters of New England and that the amounts of nitrogen found in normal waters of Massachusetts were not comparable with the normal nitrogen content of wells and streams in Mississippi Valley. There has been so much question concerning the significance of chemical data in the detection of pollution that radical views in both extremes have been held with tenacity. One side of the question was defined by Wanklyn himself. He said, "No analytical process has ever been so condemned as the ammonia-process which has surmounted every obstacle and attained to general recognition all the world over for its pre-eminent utility and trustworthiness." (2)

* Published by permission of the Director United States Geological Survey.

As another phase of the controversy Thresh quotes an English writer as follows: -(3) "It would seem, therefore, that we are face to face with the question, 'Is water analysis a failure?' It has been so exclusively the province of chemical analysts to pronounce judgment upon domestic waters and they generally have given so little attention to the large issues attached to analysis, and so very much to sets of standard figures for chlorine, nitrogen, hardness, and so on, that the attack * * * is not unexpected. There has been more wrangling over water analyses than over anything else in chemistry — and for what? Some figure in the second or third place of decimals, probably, and in regard to what this ammonia or that ammonia implies, when a visit to the source of the water and an inspection of the sewage trickling into it might settle everything." The latter quotation presents an extreme view on the other side of the question.

In recent years bacteriological studies have given a new side to the question and data thus obtained have like chemical results passed from unreserved acceptance to relegation among inferential determinations. The present status of our bacteriological knowledge and the extremely small quantities of waters actually examined as compared with the enormous volumes under consideration render it necessary to supplement such examinations by all available local data.

It seems to be the present consensus of opinion among sanitarians that chemical analysis does not establish the potability of water. Given merely the figures of a sanitary analysis, a chemist should be unwilling to take the responsibility of pronouncing a water good or bad. Reference is here made to the usual determinations and not to the demonstration of the presence or absence of harmful inorganic matter. Organic material in water is commonly estimated by the determination of nitrogen in four forms: albuminoid ammonia, free ammonia, nitrites, and nitrates, representing successive stages in the nitrogen cycle. The percentage of nitrogen contained in different forms of organic matter is variable and the percentage of it found by the common processes varies with the character of the organic matter and its stage of decomposition. Nitrogen is a constituent of harmless vegetation as well as dangerous sewage. It will, therefore, be seen on consideration that our estimates of nitrogen do not enable us to gauge absolutely the amount of organic matter present, nor what is more important, do they show its nature. We can imagine and frequently encounter waters free from pollution which show on analysis higher nitrogen content than waters containing sewage. On the other hand, we have waters containing no evidence of pollution which can not be recommended on account of their sanitary surround-

ings. While in some cases rapid decomposition, as evidenced by analytical data, leads us to believe that sewage is present, it is not direct evidence. More often, especially in mixtures of vegetable and animal matter, our chemical data either do not enable us to reach a definite conclusion or give rise to an erroneous judgment.

During a recent investigation of surface waters in Minnesota, conducted jointly by the United States Geological Survey and the Minnesota State Board of Health, many instances occurred where obvious pollution was not detected by chemical analysis owing either to the intermittent nature of the contamination or to the great content of harmless organic matter in the water before the entrance of the sewage.

EXTRACTS FROM EXAMINATIONS OF WATERS IN MINNESOTA.(4)

Parts per million.

Locality.	Relative situation.	Date.	Chlorine.	Free ammonia.	Albuminoid ammonia.	Nitrates.	Nitrites.	B. coli communis in 1 c.c. amounts.
Cloquet (St. Louis River).....	above	1/31/04	0.80	0.081	0.225	trace ..	absent	0
	at dam.....	"	0.80	0.056	0.262	"	"	+
	below	"						
	above	5/16/04	0.30	0.02	0.33	absent ..	absent	0
	at dam.....	"	0.35	0.02	0.26	"	"	+
	below	"						
	above	10/31/04	1.6	0.036	0.502	0.04	0.000	0
	at dam.....	"	1.8	0.026	0.504	0.04	0.000	+
	below	"	1.8	0.036	0.504	0.04	0.000	+
	above	2/25/05	1.2	0.152	0.322	0.08	trace	0
	at dam.....	"	1.4	0.072	0.312	0.08	"	+
	below	"	1.8	0.032	0.302	0.08	"	0
Brainerd (Mississippi River)...	above	10/26/03	1.0	0.04	0.28	trace ..	absent	+
	at intake.....	"	1.00	0.06	0.24	distinct	"	+
	below	"	1.62	0.04	0.32	"	trace	+
	above	2/10/04	0.25	0.17	0.31	distinct	trace	+
	at intake.....	"	0.25	0.13	0.30	"	"	+
	below	"	0.25	0.16	0.32	"	"	+
	above	5/21/04	0.35	0.20	0.44	trace ..	absent	+
	at intake.....	"	0.35	0.05	0.29	"	"	+
	below	"	0.4	0.19	0.41	"	"	+
	above	11/3/04	1.1	0.030	0.360	0.02	0.000	+
	at intake.....	"	1.0	0.022	0.332	0.03	0.000	0
	below	"	1.0	0.040	0.332	0.03	0.000	+
	above	2/23/05	1.0	0.073	0.230	0.04	0.002	0
St. Cloud (Mississippi River)...	at intake.....	"	1.4	0.051	0.256	0.04	0.002	0
	below	"	1.8	0.063	0.300	0.04	trace	+
	above	10/26/03	1.25	0.04	0.26	trace ..	absent	+
	at intake.....	"	1.00	0.03	0.24	distinct	"	+
	below	"	1.60	0.01	0.09	"	"	+

EXTRACTS FROM EXAMINATIONS OF WATERS IN MINNESOTA — Concluded.

Parts per million.

Locality.	Relative situation.	Date.	Chlorine.	Free ammonia.	Albuminoid ammonia.	Nitrates.	Nitrites.	B. coli communis in 1 c.c. amounts.
Grand Forks	above	1/5/04	0.50	0.22	0.14	"	"	+
	at intake	"	0.50	0.28	0.24	"	"	+
	below	"	0.75	0.28	0.25	"	"	+
	above	9/4/04	0.8	0.026	0.270	0.100	0.000	+
	at intake	"	0.4	0.086	0.818	0.100	0.000	+
	below	"	0.4	0.086	0.800	.....	0.000	+
	Sauk River...	9/4/04	0.4	0.048	0.806	0.090	0.001	+
	Red R. above	11/21/04	9.2	0.046	0.284	0.00	0.000	+
	Red Lake R. above	"	0.9	0.062	0.580	0.02	0.000	+
	Red R. above	3/30/05	9.5	0.088	0.876	0.07	trace	0
	Red Lake R. above	"	1.7	0.042	0.488	0.06	"	+
	Red R. above	5/25/05	5.9	0.000	0.570	0.05	trace	+
	Red Lake R. above	"	1.1	0.184	0.570	0.04	0.000	+
	above	1/27/04	0.25	0.085	0.37	trace	absent	+
	below	"	0.35	0.09	0.41	"	"	+
Crookston	above	11/22/04	0.4	0.044	0.550	0.08	0.000	+
	below	"	0.4	0.044	0.550	0.08	0.000	+
	above	3/31/05	1.7	0.058	0.476	.....	0.000	+
	below	"	1.7	0.072	0.476	.....	0.000	+
Grand Rapids	above	2/25/05	1.2	0.066	0.808	0.06	0.001	0
	below	"	1.2	0.064	0.802	0.06	0.001	+
Granite Falls	above	2/18/04	13.7	0.50	0.55	distinct	trace	0
	below	"	14.0	0.36	0.71	"	"	0
	above	12/5/04	4.3	0.122	0.396	0.04	0.000	+
	below	"	5.0	0.126	0.480	0.04	0.000	+
	above	3/20/05	4.6	0.158	0.440	0.08	trace	0
	below	"	4.6	0.158	0.440	0.08	"	+
Taylors Falls.....	above	10/22/04	0.8	0.098	0.192	0.04	0.000	+
	below	"	0.8	0.092	0.192	0.04	0.000	+
	above	3/15/05	1.2	0.024	0.162	0.05	0.000	0
	below	"	1.4	0.180	0.402	0.05	trace	0
Stillwater	above	10/21/04	1.0	0.062	0.420	0.04	0.000	+
	below	"	1.5	0.046	0.408	0.04	0.000	+

Cloquet, a lumbering town of about 6,000 population, discharges sewage into St. Louis River above a ground-wood pulp mill of 25 tons daily capacity, and below 5 saw mills whose average output is about 100,000,000 feet of sawed lumber per year. Samples taken

above all possible sources of pollution, next above the paper mill, and finally 3 miles below it rendered on analysis almost identical results at the three stations on four different occasions. The slight variations in the figures given may be just as logically attributed to refuse from the numerous saw mills with their attendant log booms as to the sewage which we recognize as the more dangerous pollution. Cloquet is located on St. Louis River 40 miles west of Duluth, and the first important settlement above it on St. Louis River or any of its tributaries is at least 70 miles away.

Brainerd, a city of 9,000 estimated population on Mississippi River about 150 miles above Minneapolis, contributes besides general infiltration, such pollution as might come from a ground-wood pulp mill of 30 tons daily capacity, a saw mill of 29 million feet annual capacity, and the city sewers. Five sets of samples were taken (a) above the city, (b) at the water works intake, (c) below all sewers. Sometimes a slight increase in chlorine is shown; often chlorine is alike in all samples. The nitrogen, as evidenced by four determinations on each sample runs practically constant through each set.

St. Cloud, estimated population 12,000, is situated on Mississippi River about 80 miles above Minneapolis and 70 miles below Brainerd. Immediately above it is a small village called Sauk Rapids, above which in turn Le Sauk River enters Mississippi River. Samples were taken on three occasions above Sauk Rapids, at St. Cloud water works intake below Sauk Rapids, and below all the St. Cloud sewers. Here again it is seen that the nitrogen content remains practically unchanged. The analysis of Le Sauk River above its confluence with Mississippi River is given to show that judging by the analytical results, this stream, 60 miles below the small village of Melrose, was on September 4, 1904, as dangerous from a sanitary viewpoint as Mississippi River immediately below St. Cloud, a sewered city of 12,000 population.

An inspection of the drainage areas of Red Lake River and Red River above Grand Forks, shows that Red River, receiving the sewage of Moorhead, Fargo and other large cities, carries the more dangerous pollution. If, however, three sets of examinations of both streams above Grand Forks were used as a basis of opinion, we should be forced to conclude that Red River is the better stream, because it contains less organic matter; it is as logical to attribute the large amount of chlorine in Red River to the scattered saline deposits in its area as to sewage pollution. Analyses of samples from Mississippi River at Grand Rapids, Red Lake River at Crookston, Minnesota River at Granite Falls, St. Croix River at Taylors Falls and Stillwater are also

given; many more of the same character could be quoted from work in Minnesota and in other states if time permitted. Doubtless any analyst could supply like instances from his own work. They all enforce the general observation made, namely, that laboratory methods now in use fail to detect many cases of pollution. While the test for *B. coli communis* gave results in many analyses above quoted more in coincidence with the observed chances of pollution, yet these results show their fallibility and the necessity of supplementing them with sanitary inspection.

A further examination of the analyses given above emphasizes another well-recognized feature of surface water—a continual variation in organic content. This fact, brought out more minutely by work in Ohio (5), Illinois (6), and other states, forces the conclusion that laborious and expensive examinations must be made weekly and sometimes daily or hourly for a period of two or three years in order to discover the actual chemical, physical, and bacteriological condition of any stream. Then, with all the laboratory results at hand, the meaning of them and a judgment as to the potability of the water in question must be found in the light of a comparatively inexpensive sanitary survey. So we find that our original object may be attained with much less cost and in far less time simply by omitting the analytical work.

In the examination of ground waters the changes are usually neither so rapid nor so marked, but are more difficult to reconcile on account of the relatively small amount of nitrogen found. Deforestation, cultivation, admixture of water from different formations, and fluctuations of the water-plane caused by drought, rain, or increased consumption cause as great variations in the character of underground water as do sources of contamination. Though the amount of chlorine present may serve as an index of pollution in some sections of the East, it ceases to be an important factor in the Central Plain where the heterogeneous composition of the enormous drift areas causes great differences of chlorine content in wells only a few hundred feet apart or in the western states where rivers and lake exist with water saltier than the ocean. Briefly, then, it seems to be generally accepted and the illustrative analyses quoted have tended to show that sanitary water analyses can not be interpreted by fixed standards of purity; that a few infrequent examinations lead to erroneous judgment concerning the supply in question; that the analytical results are of value only in connection with carefully-compiled data regarding all local features.

Recognizing these deficiencies what practical measures suggest themselves? The first and most obvious one seems to be that boards of health should abandon the examination of all samples of water except

those collected by their own competent representatives to gain certain specific data in problems under official consideration. A few of the numerous reasons for this step will be enumerated:

1. Dirty containers are often the source of more organic matter than the waters themselves.

2. Perfectly clean receptacles become contaminated in the hands of inexperienced collectors.

3. Bacteriological examination is useless, because of assured changes in transit.

4. The nitrogen distribution as found may not be typical of the original water on account of decomposition between time of collection and time of examination.

5. Inspection of the source of the water generally renders such examination unnecessary.

6. If the collector is asked to detail possible sources of contamination, he is required to pass judgment upon technical matters beyond his knowledge.

7. And, most important of all, after the analyst has determined by tedious and expensive processes the amount of chlorine, free and albuminoid ammonia, nitrites, and nitrates present and possibly the "oxygen consumed" or the "loss on ignition," he finds himself still in the dark without the local knowledge which only a personal visit can give. Notwithstanding the limitations of chemical water analysis recognized among men actively engaged in such work, the general public and many professional men still pay homage to the sheet of mysterious symbols comprising a sanitary analysis and cling to the belief that laboratory methods can decide the potability of water without any other data. Health officers and chemists are continually besieged with samples of water on which they may refuse to pass judgment at the expense of their popular reputations. It is flattering to be regarded as a magician who can extract from a jugful of water the past, present, and future history of the supply it is supposed to represent, but it is harmful to the public and expensive to the state for a sanitarian to propagate such belief in the infallibility of water analysis.

The second practical measure that becomes apparent is the extensive and detailed survey of all features that may affect the quality of water supplies. Experience has already shown the value of having for ready reference reliable data on the extent of sewage pollution along our streams. Since it becomes more and more apparent that the urban population of plain regions like Mississippi Valley must eventually abandon ground supplies and use filtered river water, health officers see

the importance of direct evidence regarding contamination of surface water and the means of preventing it. Rainfall, the occurrence of floods, the velocity of streams, and the extent of pollution on the drainage area afford valuable data. Graphic illustration on maps of the possible sources of pollution above a city intake usually makes more convincing testimony regarding the potability of the water than any number of analyses. Actual inspection of the walls of a well may show pollution running into it which the analyst fails to detect. As a matter of expense compared with the value of results, sanitary inspection is the most efficient weapon at hand for health officers in their war against pollution of supplies intended for domestic use.

It is not desired to assert that laboratory work is valueless or that sanitary inspection is all-sufficient. Indeed, nobody could be justified in making any such statement. There are fields where analytical results from methods judiciously chosen enable conclusions which no other data could warrant. Determining the efficiency of sewage disposal works depends largely upon comparative nitrogen determinations. The source of the nitrogen is known and the object is to assure its proper oxidation. No amount of sanitary inspection could determine the efficiency of a filtration plant; but when analyses are made it is desirable to select tests from which the results are comparable with the expense involved. For instance, it appears that results of the most practical value in testing filter plants are obtained by physical and bacteriological tests rather than by chemical analysis. When the establishment of filtration works is projected we find analytical data indispensable to paving the way for successful operation, but determinations of color, turbidity, and alkalinity made every day are more valuable than complete analyses made once a month, and we resort to sanitary inspection in the first place to convince ourselves of the necessity for filtration.

Some states — among them Minnesota and Ohio — recognizing the value of definite statistics regarding pollution problems have instituted extensive sanitary surveys. Maps are in preparation showing rivers or lakes with their foci of contamination. Reports are demanded and kept on file for reference when special features of local problems are investigated. Data regarding rainfall, increase in population, floods, the occurrence of typhoid fever and other water-borne diseases are being carefully gathered. Information thus obtained has proved of great value in the consideration of new city supplies or alterations in the present systems and will increase in value as the data are more voluminous. Along a similar line with the view of ascertaining injury done to lakes and streams by pollution, the United States Geological

Survey has prepared forms and blanks for the recording of statistics regarding sewerage, water works, and effluent-producing manufactories. Reports on effluents are gathered by personal visits to different manufacturing establishments with statements of their effect on the streams into which they discharge. All probable sources of pollution are studied and estimated in their primal condition. If any of them appear to be avoidable, steps are taken through proper channels to effect their discontinuance. For such of them as appear necessary and unavoidable, measures are considered for protection against their harmful influence.

In brief summary it may be said that careful study by practical sanitarians of the chemical and bacteriological results of analyses made not in one small section alone, but all over the country has failed to show that laboratory methods can be depended upon to detect pollution. On the other hand, sanitary survey strikes directly at the source of the evil — pollution — and affords definite bases for its removal or for protection against it. In regard to miscellaneous examinations, the whole matter has been aptly stated in a publication by one of the most eminent members of this Association, who says: "It was years ago laid down as a golden rule 'not to pass judgment upon a water the origin of which is not perfectly known,' and the nearer this maxim is lived up to to-day the fewer will be the mistakes in the reports issued." (7.)

REFERENCES.

1. Wanklyn, Chapman, Smith. *Water Analysis; Determination of the Nitrogenous Organic Matter.*—*Journ. Chem. Soc. N. S.*, Vol. V, 445, 1867.
2. Wanklyn, J. A.—*Water Analysis*, London, 1891. Preface to seventh edition.
3. Thresh, J. C.—*Water and Water Supplies*, p. 175. London, 1896.
4. Excerpts from analyses made in Minnesota, 1903-04, under supervision of Dr. F. F. Wesbrook, Director, State Bacteriological Laboratory.
5. Ohio State Board of Health. *Second Report of an Investigation of the Rivers of Ohio as Sources of Public Water Supplies*, Columbus, Ohio, 1900.
6. Palmer, A. W.—*Chemical Survey of the Waters of Illinois*. University of Illinois, 1903.
- Reynolds, A. R.—*Report of Stream Examinations*. Sanitary District of Chicago, 1902.
7. Mason, W. P.—*Examination of Water*. Revised second edition, p. 6. Wiley & Sons, 1903.

UPON THE USE OF COPPER SULPHATE IN WATER SUPPLIES.

By H. W. CLARK, BOSTON, MASS.

During the past two years, the Massachusetts State Board of Health has carried on a series of investigations in regard to the value of copper sulphate in improving water supplies, in aiding filtration and as a bactericide. These investigations were made on account of the discovery by Drs. Moore and Kellerman that certain algae, commonly found in certain water supplies, could be destroyed by the use of copper sulphate, and the publication of their bulletins by the Department of Agriculture at Washington, these bulletins including, also, data in regard to the efficiency of copper and copper sulphate when used as a bactericide, as well as information as to its value as an algicide.

To take these subjects up in different chapters, I will speak, first of the experiments made in Massachusetts on the use of the sulphate in reservoirs.

During the past two years, five ponds and reservoirs have been treated; and some of these bodies of water have been treated several times during that period. The first treatments were made either by Dr. Moore or Dr. Kellerman; and the assistant of the Board, who aided Dr. Moore in these first treatments, had charge of the dosing of the reservoirs studied by the Board. None of these reservoirs had been used as sources of water supply for a number of years, although all of them had been so used previously. All but one are located in the metropolitan district, so-called, of the state, that is, within a few miles of Boston; and the biological and chemical character of the water of each was well known through many examinations made during past years.

Describing these reservoirs by number rather than giving their names — as names are of little consequence to this Association — Reservoir No. 1 is about 35 acres in area, with a general depth of from four to five feet, a maximum depth of seven feet, and holds, when full, 56,000,000 gallons. It has a muddy bottom and a swampy drainage area. This reservoir was first treated on July 21, 1904, the amount of copper sulphate added to the water being in the proportion of 1 part copper sulphate to 8,000,000 parts of water; and the purpose of the treatment was to destroy the *Anabaena* present in the reservoir at

that time. Many other organisms were also present. The copper was applied here, as in all cases, by placing it in gunny sacks and trailing it through the water from the stern of a boat until it was dissolved. After this application to Reservoir No. 1, the *Anabaena* decreased rapidly, and entirely disappeared within six days. Other organisms present grew less for six days, when they began to increase with great rapidity, and at the end of six weeks, there were about 5,000 per cubic centimeter in the water — largely *Asterionella* and *Tabellaria*; that is, in exchange for *Anabaena*, two organisms with less offensive but nevertheless undesirable attributes, appeared. In 1905, the present year, *Anabaena* appeared earlier than usual in this reservoir, and on June 13, copper sulphate was again applied in an amount equal to 1 part in 8,000,000 parts of water. Following this, the *Anabaena* decreased in numbers somewhat, but after about three weeks, began to increase, and in five weeks after the first dosing, the reservoir was again treated. After this second treatment, the *Anabaena* diminished in numbers, but *Scenedesmus* appeared in large numbers.

Reservoir No. 2 has an area of 29 acres, and holds about 66,000,000 gallons; it is a shallow reservoir with a maximum depth of 9 feet and a general depth of about 7 feet. The water is highly colored, and always contains a large amount of organic matter. Copper sulphate was applied to this reservoir four times during the years 1903 and 1904, to clear the water of organic growths; that is, not to kill algae that were causing bad tastes and odors, but growths which, according to Dr. Moore's bulletin, could be killed by this treatment, and which were at that time giving the water a turbid appearance. The first dose was at the rate of 1 part copper sulphate in 1,500,000 parts of water, and after this treatment, the organisms increased for a day or two and then diminished. After a few days they increased rapidly, however, and soon reached a maximum of 8,000 per cubic centimeter — chiefly *Scenedesmus*. In 1904, organisms reappeared, and in numbers as high as 18,000 per c. c. — chiefly *Synedra* and *Scenedesmus*, *Staurastrum* also appeared in this year, and on July 28, the reservoir was treated with copper sulphate in the proportion of 1 part copper sulphate to 3,700,000 parts of water. Following this, the organisms decreased in numbers for a day or two, but subsequently increased rapidly, until at the end of about ten days, the numbers were greater than when the sulphate was applied. Thirteen days after this first treatment in 1904, copper sulphate was again applied in an amount equal to 1 part in 700,000 parts of water. Following this, the organisms decreased rapidly for a week, *Staurastrum* disappearing entirely but being rapidly replaced with growths of *Protococcus*, *Scenedesmus* and

other organisms, until at the end of twenty days, the number of organisms present was *greater* than at the time of the second dosing. Copper sulphate was applied again on August 30 in an amount equal to 1 part in 700,000 parts of water. Following this, the organisms decreased in numbers for a few days, then they increased rapidly and remained high until the early part of November, when they were killed by cold weather. Throughout a large part of both the years discussed, the water in this reservoir, on account of these growths of organisms and the appearance given to the water by them, was entirely unsuited for a public supply; and the copper sulphate treatment improved it little, if any.

Reservoir No. 3 has an area of about 5 acres, a depth of about 8 feet and a storage capacity of about 8,000,000 gallons. This reservoir was first treated with copper sulphate, February 28, 1905, and the quantity applied was 1 part copper sulphate in 1,000,000 parts of water. The object of this application was a study of the diffusion of copper sulphate; and the copper was applied through a hole in the ice. The results of analysis showed that the copper settled to the bottom of the reservoir and remained there, spreading but little, until the breaking up of the ice in the early spring when it diffused rapidly throughout the waters of the reservoir.

In June, three and one-half months after this treatment, when the water still contained copper in proportion of 1 part in 25,000,000 parts of water, *Uroglena* appeared in the reservoir in large quantities. Copper sulphate was then applied at the rate of 1 part in 20,000,000 parts of water, and examination of the water showed that this application, together with the copper remaining from the previous application, caused the presence of copper sulphate in the reservoir water in the proportion of 1 part to 12,000,000 parts of water. The *Uroglena* disappeared about a week after this treatment.

In Reservoir No. 4, an experiment similar to that in Reservoir No. 3, was made; that is, upon the diffusion of copper sulphate in the water.

This is a large reservoir of 45 acres, and holds, when full, 170,000,000 gallons of water. Its maximum depth is 27 feet. The reservoir is divided into two arms. On March 7, 1905, when the reservoir was frozen over, copper sulphate was applied in the proportion of 1 part in 1,000,000 parts of water, all of the copper being placed in the reservoir through the ice in the upper end of the arm which receives the main feeder of the reservoir. Samples were taken frequently during the following seven weeks, at which time the ice disappeared from the reservoir; and it was found that the copper settled to the bot-

tom of the reservoir, and while the ice remained, moved but a short distance towards the reservoir outlet. No copper was diffused into the water in the other arm of the reservoir until after the breaking up of the ice, but at this time the copper was diffused completely throughout all portions of the reservoir.

Reservoir No. 5 is about 70 acres in area and holds 600,000,000 gallons of water. It is deep, with steep shores, and its maximum depth is about 50 feet. It has been affected many years by great growths of the organism *Oscillaria*. This organism appeared in great numbers in 1903, and copper sulphate in an amount equal to 1 part in 1,500,000 parts of water was added upon September 23 of that year. The *Oscillaria* gradually disappeared from the water and did not reappear in 1904. In the year 1905, the organism again appeared in great numbers and copper sulphate was applied on August 19 and 20 in a quantity amounting to 1 part in 2,000,000 parts of water. Following this, the *Oscillaria* gradually diminished in numbers in this body of water.

In three of the reservoirs treated, the fish were little, if any, affected by the copper sulphate. In Reservoir No. 2, about 50 white perch were killed by one of the applications of copper sulphate, but in Reservoir No. 5, from four to six thousand fish died as a result of the treatment.

One other body of water in the state was treated, by parties other than the State Board of Health, with copper sulphate in a quantity estimated to be equal to 1 part in 8,000,000 parts of water; 250,000 fish, as estimated, largely white perch, were found dead upon its shores within a few days after the application of the copper. It was noticeable that in some of the reservoirs, the sulphate diffused evenly in the water when applied in the summer time, but that when applied in large quantities in one location under the ice during the winter, the diffusion was practically nil. It was also noticed in Reservoir No. 5, a deep reservoir in which stratified layers of water are found, that the copper sulphate although carefully distributed throughout the surface layers of the water, did not penetrate to any extent to a greater depth than fifteen or twenty feet, the deeper layers of water being practically free from copper.

Besides this work upon reservoirs, a large number of experiments have been made at the laboratory of the Board at Lawrence to learn the truth in regard to the bactericidal action of copper. These experiments have, in some instances, been long-continued, covering periods of one hundred days, or more. The dilutions of copper sulphate used

have ranged from 1 part sulphate in 100 parts of water to 1 part in one billion parts of water; and, while it is impossible to state in a limited time all the information collected in this manner, yet, summarizing, these experiments resulted in the main as follows:

One part copper in 100 parts of water killed all bacteria in all tests; 1 part in 1,000 parts of water killed nearly all, but a few survived this strength many weeks. Greater dilutions than 1 part in 1,000 parts, killed, in some instances, the majority of the bacteria, allowing the remainder to live many weeks, while in other experiments the bacteria were able to multiply to enormous numbers in these fairly strong copper sulphate solutions.

Experiments in regard to the effect of copper sulphate upon cultures of *B. coli* and upon coli that could be said to be "naturally present" in water, were made. By "naturally present," is meant coli which may have lived for many days in surface waters — rivers, ponds, etc., having come into these bodies of water in the sewage of a city or town.

The results of these two classes of experiments showed that *cultures* of *B. coli* were killed in twenty-four hours when treated with copper sulphate in dilutions of 1 part of the sulphate to 100,000 parts of water, and in three days by 1 part in 10,000,000 parts of water. On the other hand, the *coli that had resisted adverse conditions* and were present in *polluted waters*, were not affected, when these polluted waters were treated, by amounts as great as 1 part copper sulphate in 10,000 parts of water, or by a strength of sulphate ten times as great as that which killed laboratory cultures of the same germ.

Similar experiments were made with the typhoid bacillus. In broth cultures all bacilli were killed in twenty-four hours by copper sulphate when added in amounts equal to 1 part in 10,000 parts of water, but they were able to live many days in greater dilutions. Typhoid bacilli which had become accustomed to life in water before treatment with copper sulphate, were able to multiply in water containing 1 part copper sulphate to a million parts of water.

Many experiments were also made upon the life of bacteria in copper dishes compared with their life when in dishes made of other materials. Varying results have been obtained, but comparing the actions of other metals with copper, the experiments seem to show that the bacteria died as quickly in vessels made of zinc or iron or glass, as in vessels made of copper. Aluminum and lead were less efficient than copper.

Laboratory cultures of *B. coli* lived ten to fifteen days in copper vessels, and determinations of the amount of copper present in the

cultures of water in the vessels at the end of the experiment, seemed to indicate with a considerable degree of clearness that the rapidity of the bactericidal action depended upon the amount of copper taken from the dish, this varying at different times, and probably varying according to the reaction of the water or culture placed in the dish and the condition of the dish at the beginning of the experiment.

Besides this work, various experiments have been made in regard to the use of copper sulphate in connection with water filtration. An experiment, covering a period of a year, with an experimental filter, 17 feet in diameter and containing 30 inches in depth of good filter sand, showed that the bacterial efficiency obtained, when adding copper sulphate to the applied water in an amount equal to 1 part of the sulphate in 1,000,000 parts of water or in even greater amounts, did not improve the efficiency of filtration; in fact, the efficiency of the filter when operated in this way was less than when operated at the same rate without the addition of copper sulphate to the water. The percentage of removal of *B. coli* was much greater during the periods when copper sulphate was not added to the raw water.

It was also found, in the operation of this filter, that while considerable of the copper added to the raw water was taken from the water as it passed through the sand and deposited upon this sand, yet the effluent always contained copper sulphate in considerable amounts. The accumulation of copper throughout the sand of the filter cannot be considered as a help to filtration — rather the reverse — as the copper collected in this way, if having toxic properties, would undoubtedly in the end, and probably did in this experiment, prevent the activity of those biological actions upon which the production of a good effluent by sand filtration depends.

Summarizing the work described in this paper, the following facts are noted: *Anabaena* and *Uroglena* have been cleared from reservoirs by the use of copper sulphate — although, in one instance, the first application of the sulphate to the reservoir, did not materially affect the *Anabaena* present, and a second application was required. Application of the sulphate to kill algal growths in order simply to improve the appearance of the water in a reservoir, was not successful. In certain reservoirs large numbers of fish have been killed by the copper sulphate treatment, this being due apparently to stratification of the water and the consequent unequal diffusion of the copper sulphate throughout the reservoir. This phenomenon of stratification might cause somewhat concentrated solutions of copper to pass into supply pipes from a reservoir used as a public water supply. The experiments upon

the value of copper sulphate as a bactericide have not been particularly promising. Pure cultures of coli and typhoid have been destroyed by fairly weak solutions of the salt, but coli and typhoid that have accustomed themselves to life in water have required much stronger concentrations; and it is, of course, the more resistant typhoid germs that have persisted in water supplies that cause water-borne epidemics of this disease.

EXPERIMENTS ON THE STORAGE OF TYPHOID INFECTED WATER IN COPPER CANTEENS.*

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One of the most striking results of the researches of Moore and Kellerman on the germicidal effect of copper salts on microscopic organisms is the discovery that water brought into contact with metallic copper will dissolve enough of the metal to become distinctly toxic to typhoid and cholera germs. Kraemer and others, following up this line of research, have found that clean copper tanks, or copper strips suspended in water, exert a germicidal action. The use of copper canteens in the army and in other services where water is transported in small quantities naturally suggested itself. The hydrographic branch of the United States Geological Survey before distributing such canteens among its field parties instructed the writer to make an investigation of the whole subject to determine the value of the project. The work has been carried out during the past summer at the Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology under the charge of Mr. Marshall O. Leighton, Hydrographer-in-charge of the division of Hydro-economics of the Geological Survey.

The canteens used were of the regular army pattern made entirely of sheet copper, and when full held two quarts of water. The superficial area of copper exposed to the water when the canteen is full is 830 square centimeters or 44 square centimeters per 100 cc. of water. When holding one liter of water, the amount employed in the present experiments, the surface exposed is about 40 square centimeters per 100 cc. These figures are of interest in comparing the present experiments with those of Moore and Kellerman and of Kraemer. Moore exposed surfaces of 40 and 160 square centimeters respectively per 100 cc. of water, while Kraemer used surfaces of about 45 square centimeters per 100 cc.

CULTURES USED.

Three cultures of *B. typhosus* were used as follows:

Culture No. 2001. This culture was obtained from the laboratory of the Boston City Board of Health. It was originally obtained from the

*(From the Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology.)

Massachusetts General Hospital in 1902. It agrees with the ordinary tests for *B. typhosus*, gives the Widal reaction with known typhoid blood, reacts with rabbit serum artificially prepared by inoculation of another culture (No. 2005), and produces in a rabbit a reaction against that other organism.

Culture No. 2005. This culture was obtained in the fall of 1904 from the Boston City Hospital and is in daily use at the laboratory of the Boston Board of Health in Widal tests. It reacts with known typhoid blood, and with rabbit serum prepared by inoculation with culture No. 2001, and produces in a rabbit a reaction against that organism.

Culture No. 2006. This culture was obtained from Dr. J. H. Wright, of the Massachusetts General Hospital. It was taken from the spleen at an autopsy on May 26, 1905. The clinical diagnosis was typhoid fever. The culture according to Wright gives all the tests for *B. typhosus* including the Widal reaction. It reacts in the writer's hand with the artificially prepared sera described above.

METHODS EMPLOYED.

The canteens were cleaned originally by treatment with alkaline potassium permanganate which was allowed to stand in them over night. They were then rinsed in dilute oxalic acid solution and rinsed thoroughly with water. Since the beginning of the experiments they have not been cleaned. In all the experiments here described the mode of procedure was as follows:

An agar culture of the organism to be used was grown for fifteen hours at 37° C. From this culture a suitable dilution in tap water was made. About ten cubic centimeters of this strong water suspension were then added to a liter of non-sterile water, well mixed by shaking, and poured into the canteen. A second liter prepared in exactly the same way was poured into a second canteen and a third similar liter was poured into a glass bottle as a control. The controls were in all cases kept dark by wrapping in dark paper. Duplicate plates were immediately made from all three tests with suitable dilutions. In this way the water was inoculated with from 50,000 to 150,000 organisms per cubic centimeter. The water also was plated out and frequent blank plates were made as a check on the technique. The temperature of the air and of the water was noted. In each series two of the three cultures were used.

The number of organisms remaining in the water at the end of twenty-four hours and, in some cases, at the end of shorter periods was determined by plating on agar. All media used in this work were made according to the methods recommended by the American Public

Health Association. The plates were incubated at 37° for fifteen hours. In counting, the colonies were carefully examined and all colonies which were not typical typhoid colonies were rejected in the count. A number of these colonies which appeared to be typical typhoid colonies were fished from each plate and submitted to the Widal test. For this test I have prepared two rabbits by inoculation with cultures No. 2001 and No. 2005, so that their blood would cause the typical agglutination of the organism. All the colonies fished and tested in this way gave the reaction, thus eliminating all reasonable doubt as to the identity of the organisms in question.

At the conclusion of each experiment the copper dissolved by the water was determined. For this purpose a liter of the water was evaporated to small bulk made acid with sulphuric acid and placed in a platinum dish. The copper was then electrolytically deposited from the solution upon a spiral of platinum wire. In this way the copper was quite completely separated from other dissolved and suspended material of the water with the exception of certain metals which may be deposited with it under such conditions. The deposit was dissolved from the platinum wire in nitric acid, neutralized with ammonia, diluted, and treated with a solution of potassium ferro-cyanide. The resulting color was compared with copper standards prepared in the same way and containing known amounts of copper. A few tests of this method upon known amounts of copper dissolved in tap water indicate that its accuracy for amounts comparable with those found in these studies is within five per cent.

Three series of experiments were carried out. In the first Boston tap water was used, the object being to determine what progressive decrease, if any, would take place in the efficiency of the canteen due to the corrosion or coating over of the surface exposed to the water. Eight successive experiments were made. The effect of shorter time intervals than twenty-four hours was also studied in experiments two and three of this series. The second series consisted of a study of several waters from other localities. These waters were from the Chattohochee at Atlanta, Georgia, the Pecos at Carlsbad, New Mexico, the Colorado at Austin, Texas, and the Milk at Chinook, Montana. One experiment was made on each of the first three waters and two on the Milk River water. The third series of experiments was made on Boston tap water with the canteens which had been used in Series II and which had not been cleaned in the meantime. This set consisted of four experiments, one with each canteen which had been used with the four waters mentioned above. The effect of copper upon the typhoid organisms in Boston water having been quite clearly shown

in Series I, no organisms were added in this series. The determinations of copper were made at the end of twenty-four hours.

The results of the first series of experiments are shown in the following tables:

SERIES I. BOSTON TAP WATER.

EXPERIMENT 1. JUNE 8-9.

Canteen.	Culture.	Numbers of <i>B. typhosus</i> per cubic centimeter.	
		Initial.	24 hours.
1	2001	100,000	6
		120,000	4
2	2001	130,000	4
		90,000	7
3	2005	140,000	12
		90,000	10
4	2005	100,000	12
		100,000	15
Control			
1	2001	120,000	80,000
		100,000	70,000
2	2005	110,000	40,000
		110,000	60,000

Bacteria in water at start, 25.

Blank 0.

Temperature, Water, 17° C.—23° C. Air, 22° C.—28° C.

Copper in water at conclusion, 1.95 parts per million.

EXPERIMENT 2. JUNE 12-14.

Canteen.	Culture.	Number of <i>B. typhosus</i> per cubic centimeter.				
		Initial.	Six Hours.	Fifteen Hours.	Twenty-one Hours.	Twenty-four Hours.
1	2001	100,000	75,000	13,000	110	15
		91,000	73,000	14,000	120	12
2	2005	100,000	70,000	10,000	100	8
		100,000	65,000	12,000	70	6
Control						
1	2001	120,000				80,000
2	2005	100,000				90,000

Temperature, Water at start, 18° C. Air, 20°-30°.

Copper in water at conclusion, 1.51 parts per million.

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EXPERIMENT 3. JUNE 20-21.

Canteen.	Culture.	Number of <i>B. typhosus</i> per cubic centimeter.			
		Initial.	Six Hours.	Eighteen Hours	Twenty-four Hours.
1	2005	110,000	100,000	750	14
2	2005	90,000	80,000	800	17
3	2006	78,000	40,000	340	8
4	2006	70,000	30,000	400	9
Control					
1	2005	100,000			80,000
2	2006	80,000			70,000

Bacteria in city water at start, 14.

Temperature, Water at start, 18° C. Air, 20°-30°.

Copper in water at conclusion, 1.80 parts per million.

EXPERIMENT 4. JUNE 25-26.

Canteen.	Culture.	Number of <i>B. typhosus</i> per cubic centimeter.	
		Initial.	Twenty-four Hours.
1	2001	120,000	0
2	2001	90,000	0
3	2006	160,000	3
4	2006	110,000	2
Control			
1	2001	110,000	70,000
2	2006	130,000	80,000

Bacteria in city water at start, 23.

Temperature, Water at start, 18° C. Air, 28°-32°.

Copper in water at conclusion, 1.2 parts per million.

EXPERIMENT 5. JUNE 30-JULY 1.

Canteen.	Culture.	Number of <i>B. typho-</i> <i>sus</i> per cubic centimeter.	
		Initial.	Twenty-four Hours.
1	2001	70,000	7
2	2001	70,000	9
3	2006	95,000	4
4	2006	100,000	3
Control			
1	2001	80,000	80,000
2	2006	100,000	90,000

Bacteria in city water at start, 17.

Temperature, Water at start, 20° C. Air, 25°-30°.

Copper in water at conclusion, 1.2 parts per million.

EXPERIMENT 6. SEPT. 1-2.

Canteen.	Culture.	Number of <i>B. typho-</i> <i>sus</i> per cubic centimeter.	
		Initial.	Twenty-four Hours.
1	2001	83,000	25
2	2001	95,000	32
3	2006	68,000	43
4	2006	73,000	30
Control			
1	2001	90,000	55,000
2	2006	78,000	40,000

Bacteria in city water at start, 14.

Blank, 0.

Temperature, Water at start, 18° C. Air, 28° C.

Copper in water at conclusion, 0.7 parts per million.

EXPERIMENT 7. SEPT. 4-5.

Canteen.	Culture.	Number of <i>B. typhosus</i> per cubic centimeter.	
		Initial.	Twenty-four Hours.
1	2005	110,000	28
2	2005	115,000	24
3	2006	78,000	40
4	2006	80,000	33
Control			
1	2005	100,000	55,000
2	2006	78,000	48,000

Bacteria in city water at start, 24.

Blank, 0.

Temperature, Water at start, 19° C. Air, 20°-25°.

Copper in water at conclusion, 0.5 parts per million.

EXPERIMENT 8. SEPT. 9-10.

Canteen.	Culture.	Number of <i>B. typhosus</i> per cubic centimeter.	
		Initial.	Twenty-four Hours.
1	2001	75,000	24
2	2001	75,000	21
3	2006	95,000	33
4	2006	105,000	36
Control			
1	2001	95,000	43,000
2	2006	90,000	50,000

Bacteria in city water at start, 27.

Blank, 0.

Temperature, Water at start, 20° C. Air, 29° C.

Copper in water at conclusion, 0.5 parts per million.

The results of the first series bring out several points of interest. It will be noticed that in only one case were the organisms reduced to less than one per cubic centimeter. One is, of course, tempted to consider here that the percentage reduction was very great and to reason that if there had been initially only a few organisms present then the elimination would have been complete. Unfortunately we know little of the cause for the great range of variation in the resistance of individual organisms to an unfavorable environment, but it seems probable that such resistances to different kinds of unfavorable environment are more or less correlated so that the organism which is resistant to copper may be the very one which has survived the unfavorable environment of the stream or well. Kraemer found a greater resistance on the part of a typhoid culture grown on agar for 24 hours than with the same culture grown for 15 hours, an observation which has an interesting bearing on this question.

The fact that organisms do survive the copper treatment even in small numbers, seems, in the writer's view, to lessen considerably the value of the canteen as a safeguard against typhoid infection.

A second point of interest is the fact that the efficiency of the canteen decreases as time goes on, probably owing to the accumulation on the surface of the copper of a film of basic carbonate or other insoluble copper compound. The fact that in only eight successive treatments with water the efficiency was seriously reduced indicates that for actual service frequent cleanings of the canteen with acid would be necessary. For this purpose oxalic acid would serve admirably and the cleaning of the canteen might not prove entirely impractical even under field or camp conditions. Between experiments 5 and 6 there was a period of two months during which the canteen stood dry. It will be noticed that a much greater difference is found between the results of these two experiments than between those of any other successive experiments. Plainly the deterioration of the surface goes on in the air as well as under water.

The two experiments in which the time element was varied show that twenty-four hours is the shortest time which should be allowed for anything like a complete removal of the organisms. Although other investigators under laboratory conditions with sterilized water and clean copper plates have found periods of even two hours sufficient to remove completely all typhoid organisms from the water, yet we find that under conditions as nearly as possible like those of actual service a much greater time is necessary and the removal of the organisms is not nearly so satisfactory.

The fact that the three strains of *B. typhosus* used in these experi-

ments gave practically the same results throughout deserves mention. It has already been stated that these cultures have been on artificial media for periods of three years, eight months, and six weeks, respectively. Jackson has found a very marked resistance to copper on the part of freshly isolated cultures, and it might have been expected that a difference would have manifested itself in this case. On the contrary the three cultures acted very much alike, the advantage being first with one and then with another.

The chemical characteristics of the water probably more than any other factor will determine the result of such experiments as these, and differences in the water used doubtless explain very largely the differences in the results obtained by various observers. Especially would it appear that the results obtained by the use of distilled water are not at all comparable with those from natural waters. Moreover, the mere act of sterilizing water by heat may profoundly alter the chemical nature of its impurities and lead to correspondingly abnormal results. The differences noted by Kraemer between waters treated in various ways well illustrated this point, and more recent work by Bassett-Smith illustrated even more forcibly the different results obtained by distilled water and tap water. This matter seemed so important that the second series of experiments was planned in order to learn what effect water of various types would have upon the germicidal action of the copper canteen. The four waters used were collected from various parts of the country, and each is typical of certain peculiar conditions. The turbidity and various forms of hardness and the alkalinity were determined on each water, together with the iron, chloride and sulphate. The results are shown in the following table:

Water.	Turbidity.	Alkalinity. Carbonates and Bicarbonates as CaCO_3 .	Total Hardness. Calcium and Magnesium as CaCO_3 .	Carbonates of Sodium and Potassium as Na_2CO_3 .	Carbonates of Calcium and Magnesium as CaCO_3 .	Bicarbonates of Calcium and Magnesium as CaCO_3 .	Free CO_2 .	Iron.	Chlorides as Cl.	Sulphates as SO_4 .
Milk	0	500	620	0	62	498	0	0	120	380
Pecos	150	150	840	0	0	150	0	0.6	940	1,080
Chattahoochee ..	400	9.5	17.5	....	0	0	+	5.2	68	85
Colorado	110	137	127	11	5	122	0	0.4	8	0

The water of the Milk River was free from turbidity, but carried a large amount of alkaline earth bi-carbonates, and little calcium or magnesium in any other form. That of the Pecos had a much smaller carbonate or bi-carbonate content, also due wholly to the alkaline earths, but was very high in the so-called incrustants — other salts of calcium and magnesium; its turbidity also was low. The Chattahoochee was very turbid water with no incrustants and a very low alkalinity. The Colorado carried some turbidity together with a moderate hardness due entirely to bi-carbonates — that is, without incrustants; there were present also in this water about ten parts per million of alkaline carbonates.

The results of the five experiments made with these waters are shown in the following tables:

SERIES II. HARD AND TURBID WATERS.

EXPERIMENT 1. JULY 26.

Milk River Water. Culture 2001.

Canteen.	Numbers of <i>B. typhosus</i> per cubic centimeter.	
	Initial.	Twenty-four Hours.
1	95,000	80,000
2	100,000	88,000
Control		
1	100,000	70,000

Bacteria in water at start, 54.

Same after twenty-four hours in canteen, 40.

Temperature, Water at start, 28° C. Air, 30°.

Copper in water at conclusion, 0.2 parts per million.

EXPERIMENT 2. JULY 26.

Chattahoochee River Water. Culture 2001.

Canteen.	Numbers of <i>B. typhosus</i> per cubic centimeter.	
	Initial.	Twenty-four Hours.
1	120,000	50
2	120,000	40
Control		
1	110,000	80,000

Bacteria in water at start, 550.

Same after twenty-four hours in canteen, 500.

Temperature, Water at start, 28° C. Air, 30°.

Copper in water at conclusion, 1.5 parts.

EXPERIMENT 3. AUG. 18-19.

Milk River Water. Culture 2006.

Canteen.	Numbers of <i>B. typhosus</i> per cubic centimeter.	
	Initial.	Twenty-four Hours.
1	100,000	780
2	100,000	920
Control		
1	110,000	70,000

Bacteria in water at start, 50.

Same after twenty-four hours in canteen, 54.

Temperature, Water at start, 26° C. Air, 26°.

Copper in water at conclusion, 0.3 parts per million.

EXPERIMENT 4. AUG. 18-19.

Pecos River Water. Culture 2006.

Canteen.	Numbers of <i>B. typhosus</i> per cubic centimeter.	
	Initial.	Twenty-four Hours.
1	110,000	100
2	100,000	140
Control		
1	100,000	100,000

Bacteria in water at start, 70.

Same after twenty-four hours in canteen, 50.

Temperature, Water at start, 26° C. Air, 26°.

Copper in water at conclusion, 0.5 parts per million.

EXPERIMENT 5. AUG. 18-19.

Colorado River Water. Culture 2006.

Canteen.	Numbers of <i>B. typhosus</i> per cubic centimeter.	
	Initial.	Twenty-one Hours.
1	105,000	8
2	100,000	2
Control		
1	130,000	60,000

Bacteria in water at start, 75.

Same after twenty-four hours in canteen, 51.

Temperature, Water at start, 26° C. Air, 26°.

Copper in water at conclusion, 1.6 per million.

TABLE OF AVERAGE RESULTS.

Water.	Numbers of <i>B. typhosus</i> per cubic centimeter.	
	Initial.	Twenty-four hours.
Boston	90,000	20
Milk River	99,000	45,000
Pecos	105,000	120
Chattahoochee	120,000	45
Colorado	103,000	5

Comparing the results of experiments 1 and 4, Milk and Pecos rivers, it will be seen that the Milk River water prevented to a marked degree the toxic action of the copper, while the results with the Pecos water indicate a much greater toxicity. The amount of copper dissolved by the Milk water was 0.2 parts per million, and by the Pecos 0.5 parts. The total hardness of the Pecos water was the greater, but it was due largely to the incrustants, while the hardness of the Milk water was due to bi-carbonates entirely. It appears, therefore, that carbonates and bi-carbonates prevent the solution of the copper and consequently destroy the efficiency of the canteen to a much more marked degree than do the incrustants.

The Colorado water with some turbidity and a moderate hardness dissolved as much copper and showed as marked a toxic effect as the Boston water would have done under the same circumstances. This water is characterized by the presence of sodium or potassium carbonate equivalent, to about ten parts per million of calcium carbonate. There can be little doubt but that the amount of copper dissolved in this case was due to these alkaline carbonates which dissolved the copper by the formation of soluble double salts. The Chattahoochee dissolved about the same amount of copper as did the Colorado, but the toxic effect was much less. This, I believe to be due to the fact recently pointed out by Sullivan, that mixtures of copper salts and such insoluble silicates as kaolin obey the mass action law in that alkaline and alkaline earth salts are dissolved from the silicates and complex insoluble silicates of copper are precipitated until an equilibrium is established. This equilibrium point Sullivan found to vary

with variable conditions, especially according to the character of the silicate and its fineness. In some cases practically all the copper was deposited, in others about one-half. This observation is not only of interest in connection with the special problem under discussion, but it has a broad bearing upon the whole subject of the treatment of water with copper salts. Obviously if this reaction takes place speedily, the effect of such salts upon the organisms of the water will be neutralized to a large extent. Neither must the fact be overlooked that calcium and magnesium sulphates will often be the product of such a reaction, the permanent hardness of the water being thereby increased.

It may be stated, therefore, as the result of this series of experiments, that the copper canteen is totally inefficient in the presence of any considerable amounts of carbonates and bi-carbonates of the alkaline earths, but that the sulphates and chlorides of these metals exert a much less antagonistic effect. The presence of carbonates of the alkalis apparently assists in the solution of copper, and therefore increases the toxic action of the canteen. Turbidities due to clay or other silicates tend to precipitate rapidly, and sometimes completely, all dissolved copper as insoluble silicate, and hence destroy the toxic effect.

The absence of any solvent action upon the copper by the Milk River water may be explained in two ways. Either the chemical nature of the water precludes the solution of copper or the solution commences but is stopped by the formation of an insoluble precipitate upon the copper surface. In order to study this point Series III was undertaken, in which each of the four canteens used in Series II were filled with Boston tap water and allowed to stand for 24 hours. The results are given in the following table:

SERIES III. EFFECT OF HARD AND TURBID WATERS ON COPPER CANTEENS.

Experiment 1. Boston water.

Canteen.	Previously held water from.	Copper dissolved in 24 hrs. Parts per million.
1.....	Milk River	0.2
2.....	Pecos River	0.3
3.....	Cataahoochee River ..	1.0
4.....	Colorado River	1.8

It appears, therefore, that the alkaline waters do coat the copper surface, and that the coating protects the copper against further solvent action by soft waters, but that turbid soft waters do not thus coat the surface. They prevent the toxic action of the canteen merely by precipitating the copper as silicate after it has been dissolved. The canteen which had contained the Milk River water was opened and examined at the conclusion of the experiments. As we had anticipated the surface was found to be dark covered and heavily tarnished.

In conclusion, the principal points of interest may be summed up as follows:

1. Storage of typhoid infected Boston city water in clean copper canteens for twenty-four hours results in the destruction of the great majority of the infecting organisms. The elimination, however, is seldom complete. Any shorter period of storage is insufficient. It is quite possible that the surviving germs are the ones that would naturally have survived other unfavorable conditions in the stream or well, and hence are the ones against which protection would have been most needed.

2. Clean copper canteens become tarnished with continued use, and even on standing dry, and their efficiency as disinfecting agents becomes materially reduced thereby. They may readily be cleaned with acid.

3. Cultures which have been on artificial media for three years, eight months and six weeks, respectively, gave practically identical results throughout this work.

4. The chemical nature of the water is the determining factor upon which the results depend. Boston city water, a soft, colored surface water, prevents to a large degree the extreme toxic effect noted by some observers in the case of distilled and other waters. Carbonate and bi-carbonate of calcium and magnesium, as well as high turbidity, may completely destroy the toxic action of the canteen, the former by coating the surface and the latter by precipitating out the dissolved copper; moreover, in the former case the surface of the canteen is rendered useless for the further disinfection of even soft waters without cleaning.

It seems, therefore, that the copper canteen can claim a place only as a useful factor of safety and not in any way as a substitute for more effective means of preventing infection. It is a serious question whether or not its use would not give a false sense of security, bring about carelessness in the selection or protection of a water supply or in the handling of the water, and indirectly lead to the use of a typhoid

infected water against which the canteen itself might be found to be an entirely inadequate protection.

REFERENCES.

Bassett-Smith, P. W.—Experiments to Demonstrate the Germicidal Power of Copper and Copper Salts on Pathogenic and Non-pathogenic Organisms. *The Journal of Preventive Medicine*, XIII, '05, 388.

Kraemer, Henry.—The Copper Treatment of Water. *American Journal of Pharmacy*, 76, '04, 574.

—The Oligodynamic Properties of Copper Foil on Certain Intestinal Organisms. *Proceedings of the American Philosophical Society*, XLIX, '05, 51.

Moore, G. T. and Kellerman, K. F.—A Method of Destroying or Preventing the Growth of Algae and Certain Pathogenic Bacteria in Water Supplies. U. S. Department of Agriculture, Bureau of Plant Industry, Bull. 64, 1904.

—Copper as an Algicide and Disinfectant in Water Supplies. U. S. Department of Agriculture, Bureau of Plant Industry, Bull. 76, 1905.

Sullivan, E. C.—The Chemistry of Ore Deposition—Precipitation of Copper by Natural Silicates. *Journal American Chemical Society*, XXVII, '05, 976.

THE EFFECT OF COPPER SULPHATE UPON THE BACTERIOLOGICAL AND CHEMICAL CONSTITUENTS OF LARGE BODIES OF WATER.

By WM. ROYAL STOKES, M.D., AND J. BOSLEY THOMAS.

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The following investigation is not meant to supplement the special work of Moore and Kellerman and others concerning the effect of copper sulphate in high dilutions upon algae, since neither of us can make any pretense towards special training in algology. The limited number of experiments with algae were simply made for the purpose of comparison with the bacteriological action of copper sulphate.

In order to test the effect of copper sulphate upon algae and bacteria in large bodies of water, we undertook a series of experiments in a large swimming tank in one of the clubs in Baltimore. The water in the tank was derived from the general water supply of Baltimore. This supply is obtained from surface waters passing through the most densely populated rural district of Maryland.

This tank contained about 60,000 gallons of water, and was furnished with an overflow which let out about 500 gallons daily. This was replaced by fresh water daily. It will be seen that these conditions would correspond somewhat to a reservoir from which water was constantly drawn for daily use. The temperature of the water was usually maintained at about 70° F.

Six-tenths of a pound of copper sulphate were added to the water at the beginning of the first series of experiments, making a dilution of one part of copper sulphate to one million parts of water.

Before placing the copper sulphate in the water the number of algae were estimated by the Sedgwick-Rafter method. A reference to table No. 1 will show the exact number of algae both before and after the use of the copper sulphate, and the percentages of reduction will only be mentioned, therefore, in this general statement.

Before the addition of copper sulphate the water contained 81 algae to the cubic centimeter and 24 hours after the copper sulphate was added to the water there were 96 algae present. Unfortunately the amount was not estimated again until 48 hours later, but during this time the number had dropped to 11 algae, a reduction of 89.6% from

the maximum figure. Twenty-four hours after this count the number rose to 18, making a reduction from the maximum of 82%.

In a second series of experiments begun on January 3rd, 1905, copper sulphate in parts of 1 to 100,000 was added to the water, and just before this the water was found to contain 108 algae to the cubic centimeter. Twenty-four hours later, the number was reduced to 33, a reduction of 79%. In 48 hours only 9 algae to the cubic centimeter were present, making a reduction of 92%. In 3 days exactly the same number were present, and in 4 days 7 algae were found, a reduction of 94%. At the end of 7 days the count per cubic centimeter estimated from 10 fields had fallen to 0. At the end of eleven days the count rose to 9, and in 17 days from the addition of copper sulphate it again fell to 0.

In order to show that this reduction was not the effect of sedimentation, the water organisms were counted just after the water was admitted to the pool, and again at the end of two weeks. No copper sulphate was used during this time. There were 270 algae at the beginning and 276 at the end of the two weeks. As a matter of interest, it might be added that after passing through a mechanical filter, the number was reduced to 18, a reduction of 94%.

Ten days later there were only 3 algae present.

EFFECT OF COPPER SULPHATE UPON WATER BACTERIA.

Moore and Kellerman¹ have performed a number of interesting experiments in order to determine the effect of high dilutions of copper sulphate upon the pathogenic water bacteria. They found that the temperature of the water has an important bearing on the bactericidal action of copper sulphate. One to 100,000 parts of copper sulphate destroyed the typhoid bacillus in 2 hours at 38° C., in 4 hours at 28° C., in 6 hours at 23.5° C. and in 12 hours at 14° C. Cultures 3 and 6 hours old were more readily destroyed by the above dilution than cultures 24 and 36 hours old, showing the increased vulnerability of young cultures. The typhoid bacillus was reduced from 5481 to 0 colonies in 8 hours at the room temperature by the same dilution and 2187 colonies were reduced to 0 at a temperature of 5° C. in 24 hours.

The colon bacillus also showed an increased vulnerability in young cultures, 3 hour cultures being destroyed in 3 hours at 1 to 100,000, while it took 9 hours to destroy a 36 hour culture. It took this dilution 4 hours to destroy the colon bacillus at 38° C., and 12 hours at the room

¹ Bulletin No. 64, U. S. Department of Agriculture, Bureau of Plant Industry, May 7th, 1904.

temperature. These investigators thus showed that the typhoid bacillus is more sensitive to the action of the copper than the colon bacillus.

Gildersleeve² also performed a number of experiments with copper salts. He used flasks inoculated with various bacteria, and he found that the sulphate, chloride, acetate, and nitrate were destructive to bacteria, their activity being in the order mentioned. The typhoid and colon bacilli were destroyed in one hour by a solution of copper sulphate of 1 to 250,000, and 1 to 500,000 and 1 to 1,000,000 destroyed these organisms in from 2 to 3 hours. Such fermentative water bacteria as *Bacillus proteus*, *Bacillus cloacae*, and *Bacillus prodigiosus* were more resistant.

The first series of our experiments consisted in the use of copper sulphate in the club swimming tank in a dilution of 1 to 1,000,000. Just before the use of copper sulphate the tank contained 2,400 bacteria, and an organism producing about 95% of gas in glucose, lactose, and saccharose. A week before the colon bacillus had been found. Twenty-four hours later the colon bacillus was detected, and there were 3,300 bacteria per c. c. present. In 48 hours the count arose to 6,000, but no colon bacilli or other fermentation bacteria were detected in 1 or 50 c. c. of water, nor were any colon or other fermentation bacteria found for the next 5 days. On the third day the bacteria were 12,000, on the fourth day 7,200, and on the 8th day they fell to 1,380.

It will be seen that although this dilution had no effect in restraining the growth of the ordinary water bacteria, yet in 48 hours it destroyed the colon bacillus. Since all of the experiments made by other workers show that the typhoid bacillus is more readily destroyed by copper than the colon bacillus, it is fair to assume that if present the typhoid bacillus was also destroyed.

In the second experiment, the dilution was 1 to 100,000, and before using the copper the tank contained 3,000 bacteria and the colon bacillus. This organism disappeared in 24 hours, and the count fell to 30 bacteria. The colon did not reappear in 18 days, although the bacterial count increased. This increase was as follows: 48 hours 1,200, 3 days 4,500, 4 days 4,500, 6 days 15,600, 7 days 9,000, 11 days 12,000 and 18 days 12,000 bacteria per c. c.

In a third experiment with a similar dilution the initial count was 1,200, and *Bacillus gasoformans* producing 90% of gas in the 3 sugars was present. In 24 hours the count fell to 70 and no fermentative bacteria were found in 1 or 50 cubic centimeters of water. No fermentative bacteria were detected for 2 weeks, and the bacterial count was as fol-

²The American Journal of the Medical Sciences. May, 1905.

lows: 2 days 90, 4 days 25, 5 days 31,200, 7 days 24,000, 8 days 60,000, 11 days 24,000, 14 days 25,000. A bacterial count taken from the sediment after drawing off the water showed only 600 bacteria present and no fermentative bacteria, while a specimen obtaining from the bottom while the water was still in the tank showed 6,700 bacteria and no fermentative bacteria.

In a fourth series of tests the usual dilution of 1 to 100,000 parts of copper sulphate was used. The fresh water just let into the pool contained 1,000 bacteria, and the colon bacillus was found in 1 and 50 cubic centimeters of water. No fresh water was added to the tank during these experiments. The counts which followed in 2, 5, 6, 7, 8, 9, and 14 days respectively, were: 1800, 1350, 3000, 9000, 6720, 840, 1500 and 1800 bacteria per c. c. But although the copper did not cause any reduction in the number of water bacteria, yet neither the colon bacillus nor any other fermentative bacteria were found in tests made every day of one and fifty cubic centimeters of water.

A fifth series of tests were made by adding 1 part to 50,000 of copper. A mechanical filter had been installed in the club and the count only showed 3 bacteria. Twenty-four hours later 60 bacteria were found, and 48 hours later only 5. The number of bacteria is so small that little can be deduced from these experiments, but it seems that even 1-50,000 parts of copper will not destroy the water bacteria. It destroyed all fermentative bacteria. On another occasion, after filtration the water contained 300 bacteria. Twenty-four hours after 1-100,000 copper sulphate it contained 270, and five days after 720 bacteria.

When copper was not added, the water in the tank did not show any evidence of the increase of water bacteria. A count made just after the water had filled the pool showed 1,300 bacteria per c. c. and one week later it showed 1,200 bacteria and the colon bacillus. At another time the city water gave 1,500 bacteria, and after two weeks standing in the pool water from the top 6,000 bacteria and that from the bottom 3,000 bacteria per c. c.

A general survey of these experiments shows that a dilution of 1 to 1,000,000 has no effect upon water bacteria, but that it has a selective effect in destroying the colon bacillus and other fermentative bacteria. The same may be said of dilutions of 1 to 100,000 and 1 to 50,000. Since the typhoid bacillus is destroyed by weaker dilutions than these bacteria, it is safe to assume that these dilutions will destroy it in large bodies of water, after from 24 to 48 hours.

The last experiments were performed on a pond of irregular oblong shape which by measurement was found to contain about 262,316 gallons or 829,168 liters of water. The chemical analysis showed that the

fine mud in suspension was fine clay, and the pond was covered by a green scum of algae. It received the washings from a corn-field, and was selected as an example of impure water for the purpose of furnishing difficult requirements for the copper sulphate to overcome.

For two days before the use of copper sulphate the water contained 2,100 and 4,500 bacteria respectively and the colon bacillus was present. Twelve hours after the copper was added to the pool the water contained 3,000 bacteria and the colon bacillus, 24 hours after it contained 7,500 bacteria and the colon bacillus in 1 c. c., in 48 hours 9,000 bacteria and the colon bacillus, and in 3 days 5,100 bacteria and the colon bacillus. It will be seen that in a pond showing only moderate pollution and used as an ice pond in winter, that the dilution of 1 to 100,000 had no effect either on the water bacteria or the colon bacillus.

Table No. 1 will show the effect of copper sulphate upon the algae in detail.

THE EFFECT OF COPPER SULPHATE ON THE CHEMICAL CONSTITUENTS OF THE WATER.

Before treatment with copper sulphate the water in the swimming pool was slightly cloudy, containing 6.5 parts per million of suspended matter. It showed .09 parts of free ammonia and .12 parts of albumenoid ammonia per million parts of water. The water contained .025 parts per million of nitrites.

Twenty-four hours after the addition of 1 part of copper sulphate to 100,000 parts of water, the water became less cloudy and showed a decrease of about 32 per cent. of suspended matter. The nitrites were reduced to .021 parts and the free ammonia was reduced from .09 to .08 parts per million, while the albuminoid ammonia showed a decrease of 25 per cent.

Three days after treatment the water was clear and at the end of the sixth day contained but 0.3 parts per million of suspended matter. The nitrites steadily decreased, due to oxidation.

The free ammonia fell rapidly until the sixth day, when it unexpectedly rose, remained steady for twenty-four hours, and then decreased as rapidly as it had risen.

The albuminoid ammonia, after a decrease of 66½ per cent., showed a similar rise on the sixth day, and then steadily diminished.

After the first day following the treatment with copper sulphate, the required oxygen rapidly became less until the fourth day, after which it remained nearly constant.

Table 2 shows the analyses of the water in the swimming pool, before treatment with copper sulphate and for several days after the treatment.

Table No. 2 and diagram No. 1 show the various degrees of changes undergone by the constituents of the water after treatment with copper sulphate. It also shows the analyses of the pond water before treatment with copper sulphate and for two days after treatment. The water was very muddy and contained much finely divided clay in suspension, which accounts for the high amount of residue.

Twenty-four hours after treatment the suspended matter had decreased over 25 per cent. The nitrites decreased considerably and forty-eight hours after treatment were absent. The free ammonia and albuminoid ammonia showed a corresponding decrease.

No copper was found in any of the samples of water, but the residue, which weighed 696 grams, remaining in the swimming pool after the water had been run off, contained 7.0296 grams or 1.01 per cent. of copper. This is but 0.25 per cent. of the copper added. The copper compound was insoluble in water.

CONCLUSIONS.

From our limited number of experiments, it would seem that in fairly pure water, a dilution of 1 to 100,000 can be depended upon to greatly reduce the algae, and destroy fermentative bacteria in 24 hours, and also clear the water by precipitating the matter in suspension.

In moderately polluted water the fermentative bacteria are not destroyed.

TABLE NO. I. SHOWING EFFECT ON ALGAE.

Time after addition of copper sulphate.	Dilution: 1 to 1,000,000.				Dilution: 1 to 100,000.						
	24 hrs.	72 hours.	96 hours.	Raw water	24 hours.	48 hours.	72 hours.	96 hours.	7 days.	11 days.	17 days.
Character of determination.	Raw water				Raw water						
Diatomaceae											
Asterionella	24	37	7	11	33	14	1	7	3	7	
Stephanodiscus	7	11	1		9						
Cyclotella	11				2						
Synedra	1	1			31	13				2	
Fragilaria	1										
Surirella	10										
Encyonema					13						
Total	43	60	8	11	88	27	1	7	3	9	
Percentage of reduction.	—40	81	74			69	99	92	97	100	100
Chlorophyceae											
Raphidium	6										
Nephrocytium	2										
Scenedesmus		1									
Protococci					12	3	5	2	2		
Coelastrum					1						
Botryococci									2		
Total	8	1			13	3	5	2	4		
Percentage of reduction.	88	100	100			77	61	85	100	100	100
Cyanophyceae											
Chroococcus	20	24		2							
Total	20	24	2								
Percentage of reduction.	—20	100	80								
Schizomycetes											
Schizomycetes	9	14	2		4	3					
Crenothrix											
Total	9	14	2		4	3					
Percentage of reduction.	—55	100	88			25	100				

TABLE NO. 2. TANK IN CLUB. SHOWING EFFECT ON BACTERIA.

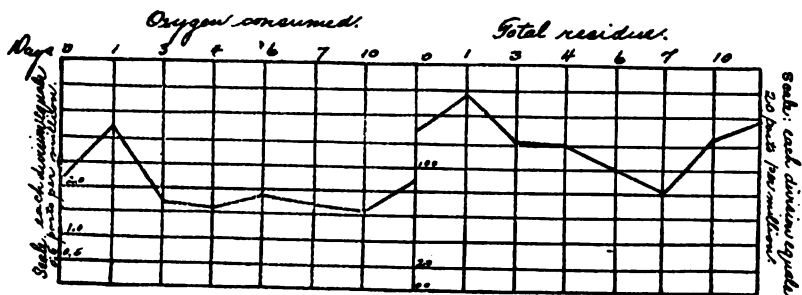
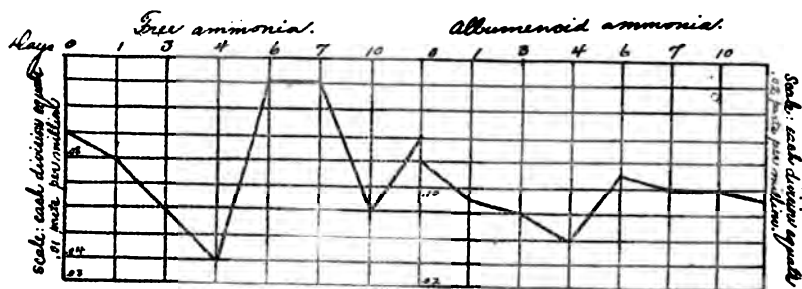
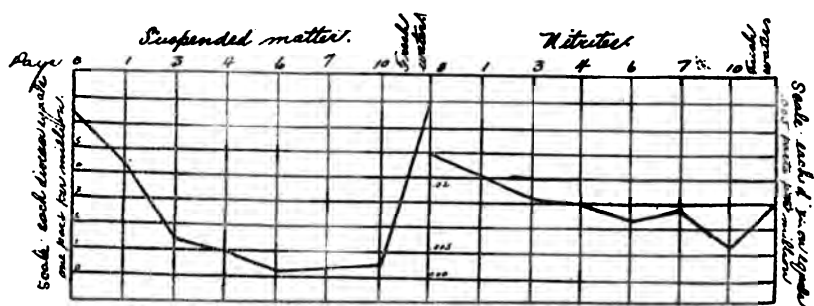
Time after treatment.	Raw water 0	24 hours	3 days.	4 days.	6 days.	7 days.	10 days.	Fresh Water.
Odor	None	None	None	None	None	None	None	None
Reaction	neutral	neutral	neutral	neutral	neutral	neutral	neutral	neutral
Color	slightly cloudy	fairly clear	clear	clear	clear	clear	clear	slightly cloudy
Suspended matter	6.5	4.5	1.5	1.0	.3	.4	.5	7.0
Total residue	128	154	122	120	112	84	126	136
Loss on ignition	52	96	44	54	26	16	24	100
Ignited residue	76	58	78	66	86	16	24	100
Chlorine	5.5	5	4	5	6	6.5	6	6
Nitrites	.025	.021	.017	.015	.013	.014	.007	.015
Nitrates	1.35	1.50	1.20	1.35	1.45	1.30	1.20	1.40
Free ammonia	.09	.08	.06	.04	.11	.11	.06	.09
Albuminoid ammonia	.12	.09	.08	.06	.11	.10	.10	.18
Sulphuric acid (SO ₃)	2.404	3.777	7.211	6.432	8.128	8.437	7.321	1.687
Hardness	88.62	92.41	88.34	75.96	73.43	91.15	79.29	86.45
Oxygen consumed	2.20	3.45	1.75	1.60	1.95	1.70	1.65	2.15

TABLE NO. 2A. MUDDY ICE-POND.

Time after Treatment.	Color.	Suspended matter.	Total residue.	Loss on ignition.	Ignited residue.	Chlorine.	Nitrites.	Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
Raw water	Muddy..	724	854	194	720	3.5	.018	.95	3.35	21.6
24 hours	Muddy..	518	654	132	522	4.0	.007	.85	2.75	17.70
48 hours	Muddy..	436	576	104	472	3.0	.000	.80	2.45	18.40

THE EFFECT OF COPPER SULPHATE.

DIAGRAM SHOWING EFFECT ON THE CHEMICAL CONSTITUENTS OF WATER,
1 TO 100,000 DILUTION.



THE DISTRIBUTION OF *B. COLI* IN THE WATERS OF LAKE ERIE, NEAR CLEVELAND, OHIO.

By GEORGE E. WILLCOMB, WATERTOWN, N. Y.

During the summer of 1904 the City of Cleveland, through its Department of Water Supply, instigated a sanitary survey of Lake Erie for the purpose of ascertaining to what extent, if any, their source of supply was being contaminated and to provide, if necessary, for the establishment of new intakes to meet the demands of a steadily increasing population. The work was in direct charge of Mr. Geo. C. Whipple, Consulting Engineer, of New York City, and the writer was Mr. Whipple's representative in the field.

The City of Cleveland, a city of about 450,000 inhabitants, is located on the southern shore of Lake Erie, about 75 miles from its extreme western end. It is situated on what is termed the Bay of Cleveland, which is merely a shallow indentation in the shore. To the west of Cleveland, lie the cities of Lorain, Sandusky and Toledo, situated on the Black, Sandusky and Maumee rivers, respectively. The sewage from these three cities amounts to approximately 62,645,000 gallons per day. Now taking the mean flow over Niagara Falls as 220,428 cu. ft. per second, which is the mean of the observations covering a period of thirty-three years, computed by the Corps of Engineers, United States Army, this would give a dilution of approximately 1:15,000, if complete mixture occurred — an amount far too small to be taken seriously into account as a contamination factor at Cleveland. It is probable, however, that many intestinal organisms, as *B. coli*, may reach the waters adjacent to Cleveland, but their numbers are so small compared to those occurring from local pollution as to be totally negligible.

The local sources of contamination of the waters about Cleveland are: The Cuyahoga River, the Rocky River, the various sewers extending across the entire lake front of the city and the dumping ground at which place the dredged materials from the Cuyahoga River are emptied.

The Cuyahoga River which, though its lineal length in miles is small, yet has a good sized watershed, flows through the city in a tortuous course and empties into the inner harbor. It is a foul body of water and its normal flow is so slight that the organic matter added to it soon settles to the bottom where it soon undergoes septic action, and it is a common

sight to see bubbles of gas arising during its course through the thickly settled portion of the city. It is utilized by the city as a kind of open trunk sewer and numerous small sewers have their outfall into it.

Along its banks are located oil refineries and slaughter houses and the refuse from these enters the river. In the spring the river is in a flood stage and the river bed is scoured by the increased velocity, and the filth is borne far out into the lake. It is evident, then, that this river is one of the chief factors of contamination of the neighboring waters of the lake.

The outfalls of the large trunk sewers extend from the city limits on the west to the limits on the east. There are nine principal ones. They are of the combined type and through them most of the industrial waste of the city is carried into the lake. The city is in the process of constructing an intercepting sewer which eventually will tap all the single trunk sewers and discharge their contents at a single point several miles east of the city. At present the sewage is scattered along the lake front and as the unit volumes are small the amount of dilution is great and sedimentation rapid, yet at the same time the intestinal organisms carried by this sewage are doubtless scattered throughout a large area by the winds and eddy currents along the shore.

The Dumping Ground, so called, is situated 2.5 miles from shore between two temporary cribs that were built during the course of construction of the water works tunnel. To this dumping ground is brought all the material dredged from the Cuyahoga River and the amount dumped averages about 10 scow loads per day. When one considers that the intake for the city's water supply is less than two miles from this dumping ground, the real importance of this contamination is at once appreciated. Such, then, are the active sources of pollution of that portion of Lake Erie adjacent to Cleveland.

At this point perhaps a few words concerning the location and nature of the water works intakes would be helpful in understanding the situation. There are two main intakes: one is located at the end of a seven-foot tunnel extending into the lake one and a quarter miles from shore, just west of the harbor entrance. This tunnel was used up to January, 1904. The other intake is located at the end of a nine-foot tunnel which extends four miles out into the lake and was first used in January, 1904.

The principal object of the work lay in ascertaining the amount of pollution existing at the new intake, if any, and also the relative amounts of pollution at different points in the bay to serve as guides for future intakes should occasion require. Accordingly, sample stations were located on four parallel ranges, the bearings of which was N-10°-W. On

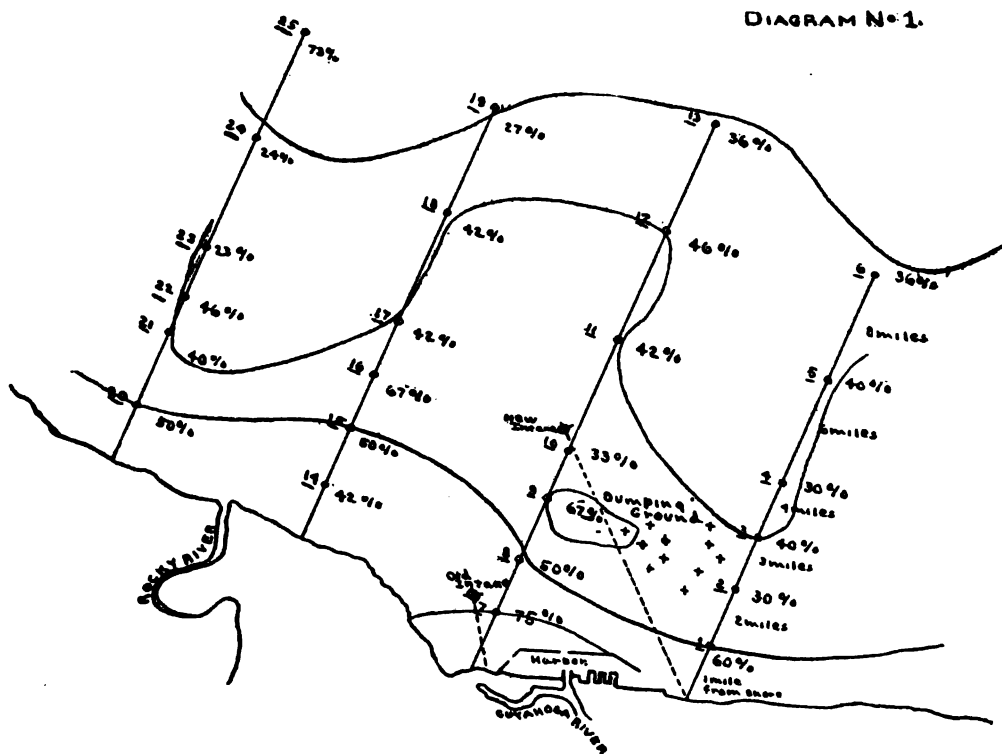
each line were located six stations at distances of one, two, three, four, six, and eight miles, respectively, from the shore. The stations were marked by buoys and the lines were about four miles apart. The extreme eastern line extended out from the last sewer outlet and the extreme western lay off Dover Bay, about 5.7 miles from the city limits. Prof. E. W. Bennis, Superintendent of Water Works, whose hearty co-operation at every stage of the work made good results possible, placed at our disposal a tug-boat and crew and it was by means of thus having a seaworthy craft in our service that we were enabled to visit the stations when the highest seas were running.

The samples collected at these stations were all analyzed for color, turbidity, chlorine, number of bacteria and the presence of *B. coli*. In most cases the presumptive test was relied upon, i. e., the formation of 10-70% total gas in from 24-48 hours in a dextrose broth tube. The organism was considered to be present if from 25-40% of this gas was CO₂ and the tube was turbid with a decided acid reaction. A great many of the cultures were run through the confirmatory subculture tests and these tests showed that the error due to the presumptive tests lay within 10%. During the course of the work a very interesting organism was met with which bore close relationship to *B. coli* and other intestinal forms and which gave 80-100% total gas in a dextrose broth tube of which 50-70% was CO₂.

In diagram No. 1 is shown that portion of Lake Erie known as the Bay of Cleveland. On it are plotted the four parallel lines of sample stations. At each station are numbers expressing the percentage of the tests for *B. coli* that were positive at each station. The curved lines connect stations that have approximately equal percentages.

The diagram shows well the contaminating factor of Rocky River, Cuyahoga River and of the dumping ground. Another interesting feature of the diagram is that it shows the influence of the prevailing wind on the direction of the river currents and hence of the distribution of coli. The period of observation extended over four months, namely June, July, August, and September. For these four months the prevailing wind was from the southwest and as seen in the diagram the general direction of the river currents, as shown by the curved lines, was northeast. It is interesting to note that the effect of these currents is not appreciably felt at the new intake. From the report of the United States Engineers "On Deep Waterways" it is shown that the total wind movement from the S. W., W and N. W. is more than half that from the other five points. The proportion of movement to time is in excess in the S. W., W. and N. W. winds, while in the other five points, time is in excess of movement. The diagram, then, portrays typical conditions.

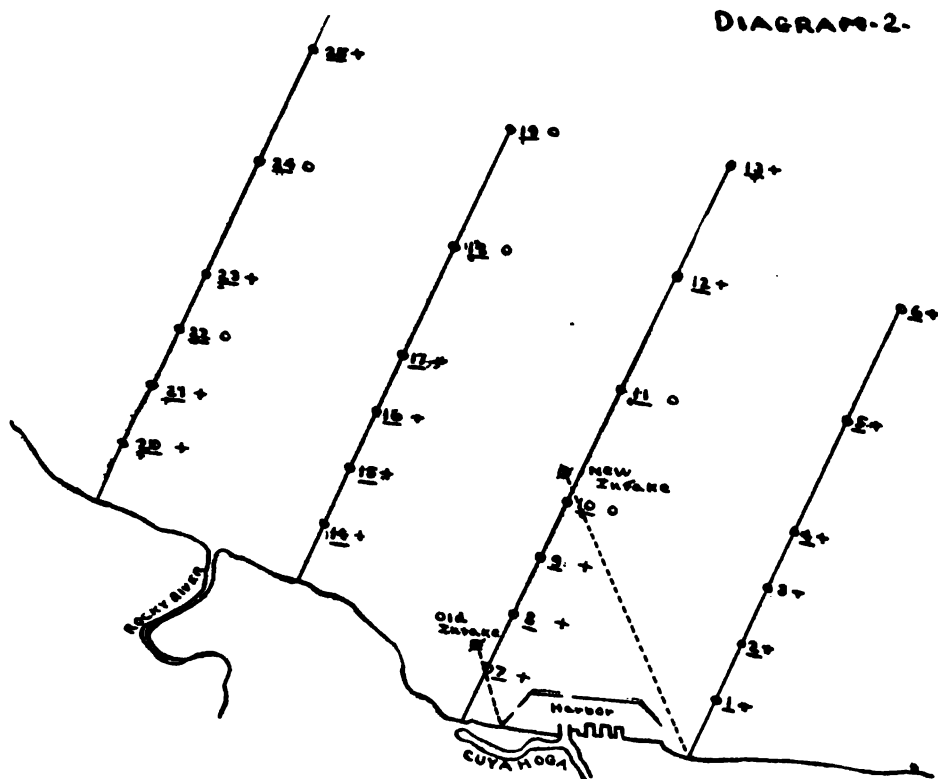
In diagram No. 2 we have the conditions on the lake after a stiff breeze from the S. W. This wind blew during the day preceding and on the day of the collection of the samples. During a portion of this time the wind attained a velocity of thirty miles an hour. We were able to obtain our wind directions and velocities with precision because on the steel crib at the water works intake was located an anemometer and standard weather vane, both of which were connected to an automatic register, thus enabling us to keep in touch with the wind conditions on



the lake at all times of the day. These instruments were set up by the Department for this work and one of the attendants at the crib cared for them. As shown by the diagram, the strong southwesterly wind caused the waters of the Cuyahoga and Rocky rivers to sweep out into the lake even as far as the extreme outer stations. All the stations on Line A gave positive tests, while all but two of the stations on Line B were positive, including the outer ones. Again, the station at the intake crib gave a negative test.

The argument has often been advanced that after a spell of continued high winds from a northerly direction the waters of the Cuyahoga

were held back at the surface by the resistance offered by the wind and that a strong undercurrent was set up in a counter direction to that of the wind, which tended to bring the lake and river levels into equilibrium. On the 26th of August, 1904, conditions obtained which were favorable for trying out this proposition. On the two days preceding the 26th the wind had been blowing almost continually from the S. and S. E., attaining a velocity at times of 45 miles an hour. This would tend to cause a strong surface flow in a N. W. direction. On the 26th a



very high wind set in from the N. and N. W., which attained a maximum velocity of 48 miles per hour in the morning. If the above assumption were correct this would tend to check the surface currents, while a strong undercurrent would be induced northward. Diagram No. 3 shows the conditions that obtained at the sample stations on Lines B and C on that day. It is seen that the four inshore stations of Line B, which were the most influenced by the waters of the Cuyahoga, gave negative tests for samples collected at the surface, while the two 50' samples gave positive tests as well as the 30' sample at Station 10. At Stations 11, 12 and 13 the undercurrent appears to have come to-

wards the surface, as shown by the positive test at the surface, and at depths of 30 and 50 feet at Station 11, and at a 30' depth at Station 12, and 30 and 50 foot depths at Station 13.

Line C bears out Line B and in addition shows the change of direction to the eastward of the river currents by the general westerly trend of the lake currents as evinced by the results obtained at Station 19. In all of the samples above mentioned the quantity of water inoculated was 1 c. c.

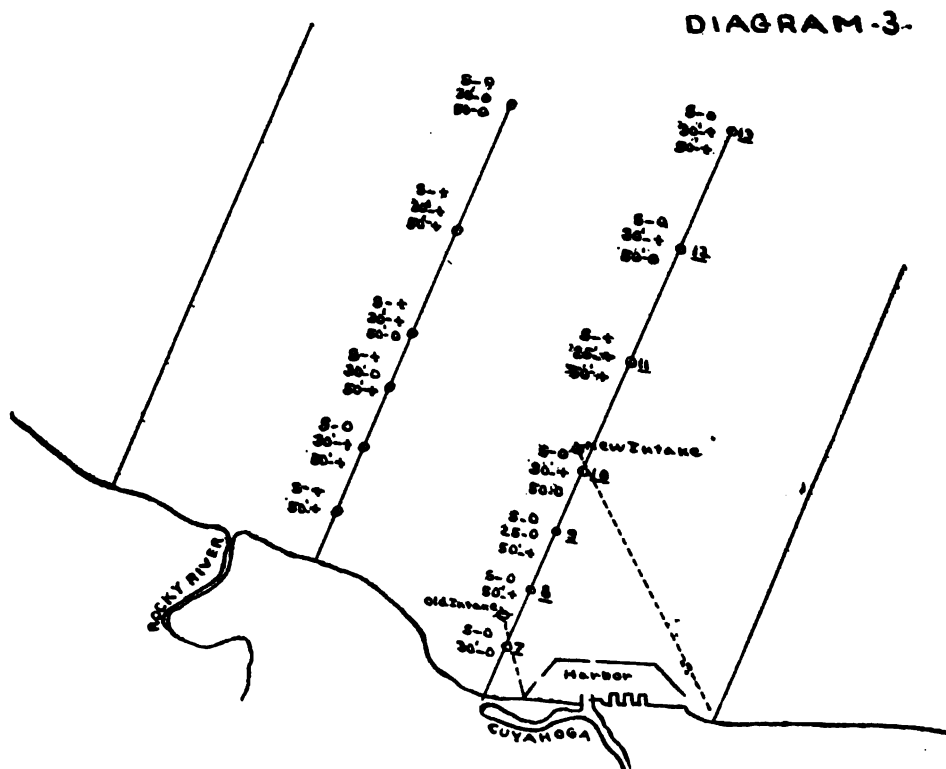


TABLE I. SHOWING THE PERCENTAGE OF POSITIVE TESTS FOR *B. COLI* AT DIFFERENT PLACES.

	0.1 c.c.	1.0 c.c.	10 c.c.
Old Intake	25%	51%	82%
New Intake	8%	16%	44%
Cuyahoga	58%	92%	92%

In diagram No. 1 near the dumping ground is shown by the crosses the positive tests that were obtained on a day when the process of dumping was actually taking place. On that day the wind was blowing from the west at a velocity of 15 miles per hour.

Such, then, are the causes affecting the distribution of *B. coli* in Cleveland Bay.

THE GROUND WATERS OF VERMONT FROM A CHEMICAL AND BACTERIOLOGICAL STANDPOINT.

By B. H. STONE, M. D., AND C. P. MOAT, BURLINGTON, VT.

The population of Vermont is essentially rural. Of its 343,641 souls, only 46,620, or a little more than 13%, are collected in the six cities. The remaining 87% of the population is scattered over the 9,565 square miles of its hills and valleys in isolated farm houses, or clustered in small villages and hamlets. As a result of this characteristic of population, there are very few public water and sewerage systems. Only forty-eight of the towns and cities in the entire state have what may be called a public water supply. There is probably no state in the country in which a larger proportion of the families are obliged to provide for their own supply of this necessity. As a result of this condition, a large proportion of the inhabitants of the state rely entirely upon private wells and springs. The condition of these ground waters of the state is then of vital importance.

It would seem that with its many hills and its sparse and widely distributed population, our state would furnish many sources for obtaining ground water of exceptional purity and it so does, as is shown by the the following analysis of a normal ground water of the state:

Turbidity.	Sediment.	Color.	Odor.	Total Solids.	Loss on Ignition.	Free Ammonia.	Albuminoid Ammonia.	Chlorine.	Nitrites.	Nitrates.	B-Coli.
v. sl.	v. sl.	0	None.	99.0	12.0	.000	.048	.4	.000	.170	None.

The normal ground water in the state is of a very definite character, especially in its chlorine content, as the comparative remoteness of the state from the sea coast causes the normal chlorine to vary but slightly throughout the whole state (from .3 parts per million in the north-

western portion to .6 parts per million in the southeastern corner). This allows a polluted water to be easily noted.

Unfortunately, the very facts which render it necessary to depend upon private supplies, result in conditions which tend to pollute these sources. The isolated farm house must also dispose of its own sewage and has been doing this in a primitive way for years. The expense of carrying this sewage to a distance is prohibitive, so that the privy vault and sink drain are allowed to take care of themselves quite largely. In some instances in the hamlets, an attempt is made to dispose of one or both of these wastes by the cess pool, which often simply results in removing this dangerous material from sight without in any way rendering it harmless. These sources, together with the barnyard and stable, are the fruitful agents of pollution. The surface drainage has been in most places guarded against, but possible dips of lower strata have been in almost all cases disregarded. Life is usually hard and money scarce in these families and the problem of going to the hills and bringing spring water to the house is one which more often than not, involves an expense not to be thought of, and in the eyes of the thrifty Yankee entirely unnecessary, when by digging a hole at his very door, plenty of water can be procured. The well then is the very common source of supply. These wells have been dug in almost every case with a view to convenience rather than the avoidance of any possible future contamination. If the householder could not see the filth of the privy vault and barnyard flowing over the top of the well, he was satisfied.

The Vermont farm and farmhouse are old; generation after generation has in turn added its dejecta to the soil which has gradually been permeated to a considerable distance so that we find the unmistakable marks of sewage, recent or remote, in many of these old wells which are considered by the users to be as unimpeachable as when they were pronounced good by their ancestors.

Since the establishment of our laboratory in 1899, we have in addition to our routine examination of public supplies, freely offered to analyze any private supplies and as a result of this offer we have made a complete sanitary analysis of 1,733 of these ground waters since December, 1901. Very few of this number were considered suspicious by their users, but were sent for analysis in many instances for mere curiosity. We only examine those samples which are sent in our own outfits. These are of the familiar variety used by the Massachusetts State Board of Health. Before being sent out, these bottles are thoroughly washed with acid, rinsed with tap and distilled water and finally sterilized with superheated steam. Upon the receipt of the specimen, steps are imme-

diately taken to ascertain the number of bacteria and the presence or absence of the *Bacillus coli communis*. The methods in use for estimating the numbers of bacteria are those recommended by the Committee of Bacterial Water Analysis of the Section. The results however are, in a great many cases, of very little use in comparing one water with another from a different source, for the reason that the time elapsing between the collection of the sample and the plating is subject to much variation according to the locality. It is impossible, except in a few places, to have the plating done in the field.

In testing for the *Bacillus coli communis* we have developed a method of our own which has given excellent results. In doubtful cases we fall back on the full confirmatory tests as recommended in the Lawrence methods. During the four years which we have been using the method, we have tested out many of our positive results with the full confirmatory tests and have found the percentage of discrepancy so small as to be of no account. It is absolutely impossible to employ the full set of culture tests in all the waters which we are called upon to handle and so while agreeing in the advisability of these as standards, we firmly believe that our method gives us just as good results in routine work and allows us to handle a much larger number of samples.

The method consists of a combination of other methods which have been advanced from time to time in which we have tried to add the essential features of each without making the process too cumbersome. Seventy-two hours is all the time required to complete the test and decide whether or not colon bacilli are present in the one c. c. of water used. We have already much and are accumulating more data on the efficiency of the test, which will be published at some subsequent time.

The following is the test used in our routine work:

(a) A fermentation tube filled with a 2 per cent. faintly acid lactose peptone broth to which has been added 1 per cent. of one-half of 1 per cent. aqueous solution of neutral red, is inoculated with 5 cubic centimeters of the water to be examined, or 5 tubes are inoculated with 1 cubic centimeter each. If no gas is found after an incubation period of twenty-four hours at 37° C., the absence of the colon bacillus is shown.

(b) If from 20 to 70 per cent. of gas is formed in the closed arm, a tube containing neutral peptone broth, to which has been added 3 per cent. of Parietti's solution, is inoculated with one-half cubic centimeter of the contents of (a) and incubated twenty-four hours at 37° C.

(c) A second fermentation tube is now inoculated with one-half cubic centimeter of the contents of (b) and grown twenty-four hours at 37° C. If there is no gas we may be sure the gas producer in (a) was

not the colon bacillus. If, on the other hand, 20 to 70 per cent. of gas is produced in this tube with the characteristic neutral red, yellow-red reaction (Stokes), we may be reasonably sure that the colon bacillus is present.

Further confirmation is obtained by ascertaining the gas formula from (c). Lactose litmus agar plates are made at the time of inoculation of the first fermentation tube for count of acid colonies and body temperature colonies.

After the bacteriological samples are taken, the chemical examination is made. This consists of the determination of free and albuminoid ammonia, nitrates and nitrites, chlorine, total solids, and loss on ignition and the physical examination of sediment, turbidity, color, and odor. These are mostly carried on according to the standard methods.

In the following table I, the result of the analyses are grouped in accordance to their chlorine, nitrogen and bacterial content. These determinations were chosen from the complete analytical data as being most important from a sanitary standpoint and as lending themselves best to tabulation.

Groups 1-5 (inclusive) represent waters which show chemical evidence of a contamination more or less remote and which have been thoroughly filtered in their subsequent passage through the ground.

Groups 6-9 (inclusive) show chemical evidence of a recent pollution and group 10 shows waters which are chemically normal. The interpretation of these groups is complicated by the presence of the *Bacillus coli communis* in certain of the samples, showing that there is minute pollution which is undetected by chemical methods.

Table II groups the waters whose analyses give chemical and bacteriological results which are entirely consistent with each other and those in which the results seem at first to be at variance.

Group A of this table is evidently composed of waters which have been polluted with organic matter, but at a time remote enough for the nitrogen to have been completely oxidized. With the absence of the colon bacillus, this water is probably safe, although any water which has received pollution in the past may not always be well purified in its passage through the ground. A majority of these specimens coming from wells adjacent to barn, sink drain, cess pools or other source of contamination are merely examples of thorough filtration.

Group B needs no comment. We should expect the waters of this group to show intestinal bacteria and they do.

Group C are the perfectly normal waters.

TABLE I.—TABLE OF CHLORINE, NITROGEN AND B. COLI DETERMINATIONS IN 1733 VERMONT GROUND WATERS.

(1) Cl. 8. or over Nitrates over .500 NH ₃ under .010 Nitrites under .002		(2) Cl. 8. or over Nitrates over .500 NH ₃ .010 or under Nitrites .002 or under		(3) Cl. between 1. and 8. Nitrates over .500 NH ₃ under .010 Nitrites under .002		(4) Cl. over 1. Nitrates low NH ₃ low Nitrites low		(5) Nitrates over .500 Cl. low NH ₃ low Nitrites low		(6) Cl. 1. or over Nitrates over .500 NH ₃ over .010		(7) Cl. over 1. Nitrates under .500 NH ₃ over .010		(8) Cl. under 1. NH ₃ over .010 Nitrates over .500		(9) Cl. under 1. Nitrates under .500 or NH ₃ over .010		(10) Cl. normal under 1. Nitrates under .500 NH ₃ .010 or less Nitrites under .002	
(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll	B. Coll	No B. Coll
No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r	No Col'r
10	10	3	12	8	65	9	15	10	126	11	45	12	67	89	343	32	87	8	51
20	80	15	73	24	136	24	136	79	432	119	59	29	204	57	350	233	407	407	407
100		88		160		56		79		432		119		59		233		407	
				483		843													

TABLE II.—ANALYSES IN WHICH CHEMICAL AND BACTERIOLOGICAL RESULTS

Are consistent				Are not consistent			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Chem. Prev. contam. High Cl., Nitrates or both Low NH ₃ Bact. No B. Coll	Chem. Recent contam. High NH ₃ B. Coll present (Recent contam.)	Chem. Good water Low Cl., NH ₃ , Nitrates and Nitrites Bact. No B. Coll	Chem. Prev. contam. High Cl., Nitrates or both Low NH ₃ Bact. B. Coll present (Recent contam.)	Chem. Recent contam. High NH ₃ Bact. No B. Coll High Cl., Low Cl., 450 255	Chem. Good water Low Cl., NH ₃ , Nitrates and Nitrites Bact. B. Coll present	Total.	Total.
401 83+ %	158 18— %	350 86+ %	82 17 %	685 82+ %	57 14 %	824 48 %	824 48 %

Group D includes those waters in which the chemical examination show, like Group A, the nitrogenous material in the stage of complete oxidization, but which give evidence of some recent intestinal pollution by the presence of colon bacilli in 1 c. c. samples.

Group E presents the most surprising inconsistency between chemical and bacterial results. These waters show chemical evidence of a recent pollution, so recent that it is inconceivable that the intestinal bacteria could have ceased to live and yet none are found. Many of the waters in group E we suspect are examples of sink drain pollution. One-half of them show a chlorine content considerably above the normal (see 6b and 7b), with a comparatively low nitrate content, a condition entirely consistent with the composition of sink drain waste.

It is probable that the examination of larger amounts of water would have shown the presence of *Bacillus coli* in some of these specimens.

In group F we find 57 waters which are chemically unimpeachable, but which show the presence of sewage bacteria. This may of course be due to accidental contamination or to some minute surface pollution.

The surprising thing is that in a total number of 1,733 waters there were only 350 normal specimens, all of the others show some evidence of pollution either past or present and this in a state where pure water can be easily found. In 909, a trifle over half of these waters, the chemical and bacteriological findings confirm each other and in 139 of the remaining half, the bacteriological examination seems the more delicate test, while in 685 the chemical examination shows a pollution which went undetected by bacteriological examination.

We are not accustomed to condemn a water whose only fault is the presence of colon bacilli, unless we find them habitually present. A large number of the spring supplies are all right in the winter months, which lead us to suspect that the bacteria have their origin in cattle evacuations. In such cases we are accustomed to call attention to the condition and suggest the source; at the same time requesting another sample.

Why, then, is there no greater prevalence of water borne disease among the users of the water from these polluted wells? This is easily explained by the fact that any contamination which gains access to this water must of necessity come from a limited number of people. One case of typhoid may pollute the water supply of a large city, while the direct infection of one of these wells with typhoid excrement will only endanger the few users of that supply. A critical study of the vital statistics of New England does, however, show some interesting figures which coincide with the condition of the waters described above. The

total death rate per 100,000 from typhoid fever in Vermont is 31.1. Of the urban population, the rate is 27.8, while among the rural population it reaches 31.7. This is the highest rural death rate in any New England state and Vermont is the only state in New England in which the rural death rate is higher than the urban.

A number of these supplies have been abandoned and we expect these figures to be changed for the better owing to the work done at the Laboratory in showing the true condition of these waters.

THE READJUSTMENT OF EDUCATION AND RESEARCH IN HYGIENE AND SANITATION.

By WILLIAM T. SEDGWICK,

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In Herbert Spencer's well known definition, continuous adjustment is seized upon as the essential characteristic of life, and in any vital enterprise such as business, government, education or research, frequent, if not continuous, adjustments and readjustments are indispensable. In the present paper I propose to inquire whether the time has not come for a readjustment of our definitions and methods of research and education in hygiene and sanitation. And if it turns out, as I think it will, that such is the case, I shall venture to indicate some of the steps required to be taken in order to bring about readjustment.

We shall gain in perspective more than we lose in time if we recall briefly how the conditions that now prevail originated. In doing this we need not go further back than Pettenkofer, for with him, his associates and successors, scientific hygiene and sanitation as these exist to-day began. It is true that the Greeks valued the *mens sana in corpore sano* and earnestly strove to attain it. It is true that Combe and Kingsley and many other English laymen did good public service in the middle of the nineteenth century by preaching that cleanliness, public as well as private, is next to godliness. It is true that Johannes Müller and his successors laid the basis of a rational personal hygiene by working out the basis of a rational physiology. But the first to bring to bear upon hygiene in all its branches, so far as then known, the exact methods of chemistry, physics and physiology; the first to emphasize adequately the importance of good water supplies and especially of good sewerage; the first to examine scientifically the ground, and ground air, and ground water, the porosity of the walls of houses and, in general, those environmental aspects of hygiene to which we give to-day the special name "sanitation" — was Max von Pettenkofer, Professor in the University of Munich, with his associates and successors.

In recognition of Pettenkofer's pioneer work and the importance of the science which it represents, a new institute, the Hygienic Institute, of which Pettenkofer was made the Director, was added to those al-

ready existing in the University of Munich and this building, located near the Physiological Institute and like that situated upon a street which now bears the name of Pettenkofer, should be a shrine of pilgrimage for all hygienists both as Pettenkofer's laboratory and as the first of a long series of hygienic institutes established since then all over the civilized world. Up to this time Pettenkofer had worked in the physiological institute with his friend and colleague Voit, so that the new science of Hygiene may be said to have sprung directly as a branch from Physiology, then as now, a fundamental member of the group of medical sciences. The connection of hygiene with medicine, or at least with physiology, is thus ancestral and phylogenetic. But while hygiene began, and must always begin, with physiology, it did not and cannot end there. Pettenkofer's own work even, soon led him into questions of public hygiene, involving, for example, chemistry, physics and engineering, into air analysis, soil physics and problems of water supply and sewage. And so urgent and promising were these problems of the public health that the physiological problems of individual or personal hygiene soon played but a small part in the work of the new Institute.

This tendency to depart from physiology thus early discoverable in this first hygienic institute, was a recognition — perhaps an unconscious recognition — of a fact which has since become perfectly clear, namely, that the sphere of hygiene is naturally separable into two distinct hemispheres, one dealing directly and chiefly with individuals or masses of individuals, the other directly and chiefly with their environment. And inasmuch as it is this tendency and this differentiation which have, as it were, thrown out of adjustment our earlier methods of research and education in hygiene, making necessary that readjustment which it is the purpose of this paper to propose and promote, we must before going further observe carefully how far this differentiation has proceeded already, and how far it is likely to go in the future.

If we examine any recent textbook professing to cover the whole field of hygiene we cannot fail to be struck with the variety, not to say incongruity of the topics treated. This is especially true of the German textbooks, taken as a whole, but is also characteristic of some English and American textbooks. Subjects as unlike as muscular exercise and street cleaning, or foods and railway sanitation, are grouped together, so that the reader who turns the pages cannot help wondering if hygiene is not the most comprehensive of sciences and a hygienist the broadest of men. Moreover a student of the science of health soon hears the words "sanitary" and "sanitation" as well as "hygienic" and "hygiene" and may well ask exactly what each and all mean. If he

be interested in research rather than education he will meet not only with hygienic institutes, but also sewage experiment stations, food and drug laboratories, and laboratories of sanitary research; laboratories of sanitary chemistry, water analysis, food analysis, etc. These various differentiations are largely the outcome of the marvelous additions to our knowledge, and especially to our knowledge of the environment, within the last half century. Almost every discovery in science, almost every advance in engineering, has contributed some fact or condition of practical interest or importance to general hygiene. The pressure of population, the migration from country to city, labor-saving machinery, the growth of traveling, the enrichment of our dietaries, the factory system, high buildings, cold storage, and a thousand other modifications of our ways of living,—all these have opened up problems of hygiene previously either non-existent or unknown. To-day we are also beginning to appreciate the importance and power of the protoplasmic human mechanism, which has to struggle for existence and success under these various conditions, and to look to the physiologists for a more intimate knowledge of its normal operation.

Meantime, in America at least, research in hygiene is comparatively sporadic if not desultory, and educational opportunities are few and unsatisfactory. Hygiene is allowed only a modicum of time in our medical schools and little or no place in schools of engineering. And yet its importance to modern society is unquestioned. Never before has a higher value been set upon the working efficiency of the human machine. Never before have preventive medicine, hygiene or sanitation occupied so high a place in the public esteem. Why is it, then, we may well ask, that medical schools pay so little attention to a subject so important and at the same time so closely connected historically and practically with medical science? The answer to this question will, I believe, establish the truth of my thesis that readjustment is required, and will also reveal some of the steps required to bring about such readjustment.

In spite of its admitted importance, hygiene occupies only a very small place in our medical schools, partly, I believe, because *sanitation* has become so large a part of hygiene, and sanitation belongs in schools of engineering; and partly because for medical men there are, in our country, very few attractive positions in the applications of hygiene. Let us consider the first point more carefully. It is to-day absurd for the average well trained medical student to think of becoming an expert in such branches of hygiene as water supply, sewerage, heating and ventilation, street building, cleaning and watering, garbage collection and disposal, gas and other forms of light supply, ice supply, milk

supply, the abatement of nuisances, etc. These belong rather to the sanitary engineer, sanitary chemist and sanitary biologist; to sanitation rather than hygiene.

Closer to the physician's own work, and yet almost a science in themselves, are the problems of personal hygiene, muscular exercise, sleep, foods and feeding, bathing, clothing, mental work, and the like. Half way between personal and public hygiene, lie such subjects as school hygiene and school sanitation, epidemiology, quarantine, the control of foods and drugs. If the modern medical student can find time for a thorough acquaintance with bacteriology and serum science he is probably doing all that we ought to expect of a well trained beginner in medicine or surgery. The difficulty here described suggests its own remedy. Why not begin in our readjustment by making a sharp distinction between the hygiene of the individual and that of the environment, keeping for the former the older, broader and historic term *hygiene*, and giving to the latter the term already almost universally applied to it (unless in Germany), namely *sanitation*. Next, why not frankly give up the pretense of teaching in medical schools of more than the most general and elementary principles of water supply, sewerage, heating and ventilation, street construction, street cleaning, street watering, plumbing, gas supply, ice supply, milk supply, and the purity of foods and drugs, leaving these to sanitarians — engineers, chemists, and biologists. Freed from these subjects, courses in hygiene might be given in medical schools which should be practically valuable to medical men, dealing as these should chiefly with its personal aspects, and yet involving many of the most important matters relating to the public health. Such courses would be essentially medical, or at least physiological, and are to-day greatly needed. I think I am within the truth in saying that in some engineering schools sanitation is to-day better taught than personal hygiene is in any medical school; and this surely ought not to be, and need not be, true.

As for research, it is idle to expect the ordinary medical man to be greatly interested in or to spend much time upon the detailed problems of water or sewage purification, even if he has — as he generally has not — the requisite training. We must expect this work to be done by engineers, chemists, and biologists, and not by physicians. And its teaching belongs in schools of science and engineering rather than in medical schools.

At the same time another and fundamental readjustment is sorely needed, which, if it could be effected, would do more to promote good teaching and research in hygiene and sanitation than any other one thing. This is the establishment of *permanent, well-paid positions* in

the service of the public health. I am not sanguine that this readjustment — the most fundamental of all, and one which, if it could be made, would speedily bring about the others — is either easy or imminent, and yet I believe that we should never cease for an instant to proclaim its necessity or to work for it. Somehow or other, we must in America secure a large group of well-paid public health officers who shall have powers of more than local jurisdiction or at least more than local visitation, criticism and advice; who shall be supplied with laboratories and other means of experiment and investigation; and who shall be able and willing to call to their aid and co-operation, sanitary engineers, sanitary chemists and sanitary biologists. These public health officers will naturally be medical men, but they will not be ordinary medical men. They must be specially trained for the work; they must know more of infectious than of chronic diseases; more of medicine than of surgery; they must be thoroughly equipped in epidemiology and must have a general but sound elementary knowledge of sanitation; they should know and use statistics; and above all they should possess tact, courage and firmness. When the places for such men are provided the men will soon be found. A medical school will then gladly give courses, not only in hygiene but in public health, such as will prepare good candidates. I believe it to be our first duty to work for the establishment of such public health positions, and all that is needed to secure them is a general readiness to surrender some local pride and some local importance, for the sake of national progress, mutual benefit, and the advancement of science.

Meantime we must look to our universities and technical schools for the maintenance of the very best hygienic laboratories and sanitary experiment stations which they can afford, and to our states and cities for the best that money can buy. Even these are not enough. Brief but comprehensive courses in the theory and practice of hygiene, and especially personal hygiene, should be offered in all medical schools, and in the theory and practice, of sanitation, in our technical and scientific schools. In this way the road would be open to all — physicians, scientists and engineers — to become grounded in the general principles of hygiene, while for those whose tastes and abilities led them to go further, the research laboratories already mentioned, and the positions referred to, would offer an incentive and hold out inviting and honorable careers. It is hard to think of any consummation at present more devoutly to be wished for in the United States or more certain to redound to the promotion of the public health and the public welfare.

Politics must also be wholly eliminated from our boards of health, both state and municipal. There is no republican method of vaccination,

no democratic plan of street cleaning. And places on boards of health must not be used as rewards of political activity. The time, if it ever existed, has gone by when a proper board of health can be made up of a political doctor, a political saloon-keeper and a political nobody; for no well-trained and self-respecting expert in hygiene or sanitation can or will long remain in the dubious and uncertain service of such weak, incompetent or shifty characters.

EDUCATION OF AND CO-OPERATION WITH THE GENERAL PUBLIC IN HEALTH WORK.

BY PROF. F. C. ROBINSON, BRUNSWICK, MAINE.

It is eminently fitting, it seems to me, that one of the topics on the program of this meeting is education in its various phases as they bear upon Public Health. This Association was founded for educational purposes, and when it ceases to be educational there will cease to be any reason for its existence. And the education it was founded to promote is not that of a few specialists only, but of the general public. As a result of the specialization in all directions, there has been great activity in the formation of special societies; and to many it has seemed that these would, and ought to, result in the doing away with the older ones formed on a broader basis. But the last few years has witnessed a renewal of interest in the general societies, for it is clearly seen that they can do an educational work which the narrower ones cannot. There are probably some present at this meeting who remember the great cholera and smallpox epidemics which prevailed to so wide an extent in the United States in the early 70's. It was then and because of these epidemics that this Association was formed; and the papers and discussions at those first meetings reflect the strong purpose of its founders to make it a means of educating the general public. Sanitary science was then in its infancy, if indeed it was born; but it was seen that the only way its general principles could be made effective was to educate those who ought to make use of them.

Most admirably has that purpose been held to during the more than thirty years since then, and I believe that if it were possible to separate from the completed whole all the influences which have operated to make the public of to-day more responsive to sanitary demands than they formerly were, prominent among these would be found the work of this Association. But when we inquire how this has been done, and how we of to-day can best carry on the work, the answer is not easily made. Of course we know that the Association by its yearly meetings comes into direct contact with but a small part of the general public; and however valuable the papers presented may be, their circle of readers after they are gathered into a volume is small. But its activities have never been confined to its annual meetings, but through its officers and committees it has kept up its work throughout the year,

originating or aiding whatever movements were in the interest of sanitary progress. Thirty years ago very few of the states had state boards of health, and it was one of the first works of the American Public Health Association to urge their establishment and recommend their line of action. One of the most effective means of correcting abuses is to point them out clearly, and in the early days of the Association its secretary was accustomed to prepare annually a sanitary survey of the United States, taking up each state and giving its health conditions and their causes in a most readable manner. These were doubtless made use of by those who were striving for better conditions in the states, to influence public opinion; and must have been very effective. But of course, now that practically all the states have boards of health, there is no need for the Association to continue that kind of educative work.

In fact it would almost seem as though the general public was now fully informed on sanitary matters, and ought to be ready to co-operate in carrying them out. State and local boards of health are found everywhere; sanitary bulletins and magazines have multiplied; the daily papers have science and health columns; health foods, health shoes, health corsets even, are widely advertised, and many of the advertisements seem like actual treatises on hygiene and public health. If these things don't educate the general public, what will? Is it possible that I can suggest in this brief time anything else more effective? Isn't the sanitary millennium almost in sight?

As one interesting comment on this, we find in reading of the recent yellow fever epidemic in the South, that one thing brought forward to account for unsatisfactory conditions was that "there are too many boards of health: every town has one." The very agency which this Association once thought would be all that a state needed to insure its sanitary salvation was here thought to be working for its damnation!

Now I for one do not believe that there is yet too much sanitary organization, but organization which is not itself organized is worse than useless. A board of health in a town does not of itself assure proper sanitation there, and more than a school committee assures good teachers.

In fact the condition of the general public to-day in regard to public health is another illustration of the truth that increased knowledge always leads away from the simple to the complex. As long as we see a subject largely and in outline only, its relations seem much simpler than a closer view shows them to be. Every door of knowledge we open seems to reveal two more at least, ahead of us, doubly locked; when we think that a single move will check our opponent and win for us the

game, we suddenly find that having made it, we have but started a new combination wholly unexpected, and much more intricate than the other.

There was a time when the general public was much more of a unit in sanitary knowledge than it is to-day, that is, all were about equal in ignorance. Now we have several distinct kinds of general public, and I am sorry to say that what is truly called the intelligent class is not always the one which co-operates best in public health measures. Health knowledge seems to act on people differently from other kinds, especially those scraps of health knowledge which are served up to the people nowadays in so many forms — predigested knowledge brought on with one's predigested breakfast food. Such scraps of knowledge, when they concern Russia or righteousness, elephants or electrons, entertain and instruct, but otherwise have little influence upon us. In fact they can be given to us over again within a short interval just as the material of our breakfast food can, provided its form and package be changed, and we will experience again our original delight in it. But health knowledge, especially that skilfully constructed for advertising purposes, takes hold of a great many people, and especially educated people, in a far different way. It acts by some such principle as auto-suggestion, and leads to the adoption of all kinds of hygienic contrivances to ward off the dangers imagined to be near. One day, in obedience to information gained, they consider their bodies as mere machines, whose parts need simply certain manipulative adjustments from time to time in order to keep them running properly, and the next day, perhaps, they are mysteries which nothing material will affect. I have seen the statement that there are 6,000 regular physicians of different schools in New York City, and 20,000 quacks. If that is true, what a comment it is upon health education, and its results in that metropolis! And there is no reason to suppose that they are "above all others" in this respect. Public health work in its broadest relations must take knowledge of such conditions and try to remedy them.

We talk glibly about instruction and education as the great and only things to be desired in sanitary matters, but we are face to face with the fact that, in this as in other cases, the results of education are not so simple as theorists would have us believe. Other papers will deal with the instruction given in school and college, and directly to boards of health, and I have no doubt but that there is great help in the work, to be derived from a fuller use of those opportunities; but there is a great, and I fear growing portion of the public, in a sense educated, who are bound to be more and more in the future a hindrance to our work, and I wish I could see some sure way to reach them. But I am an

optimist by nature and cultivation and I feel confident that some way will appear.

What we need in this, as in all other kinds of education, is some sure way to impart educational immunity, if I may use the word in this connection. An educational immune is one who can come in contact with all sorts of wild, noxious educational germs, and get no crank disease from them. Complete educational immunes probably are rare, but still there are some in every community. It is more common to find them immune in respect to certain kinds of knowledge and not towards others, and as I have intimated before, the most prevalent noxious educational germ, and one for which an immunizing serum is much to be desired, is the *bacillus healthcrankiosus*. It goes without saying that every efficient health officer or sanitarian should be such an immune at least, even though he has become so, as I fear many of us have, by having had the disease in some form.

It seems to me that it is the great work of this Association, and similar ones throughout the world, to attack and help solve this great problem, to elaborate this serum, if you will. The time has gone when it is most profitable for the American Public Health Association to address its work chiefly to be uneducated in sanitary matters. That was necessary in the beginning, but now can be done better by the agencies in the different states which can work at shorter range. Its meetings and proceedings should be planned to catch and hold the attention of the educated classes, and whatever it sends out with its endorsement should be in the highest sense "sane and safe." It is too much to expect that all papers presented shall have the endorsement, as to the ideas expressed, of a majority of the officers even of the Association. It is exceedingly desirable that radical views should be expressed, provided they are logically stated and are the result of careful thought, but in such cases provision should always be made for discussion which will state clearly other views.

If we love this Association, if we love the work it is doing, we will not fail to take our share of its duties, and there is, as it seems to me, no higher duty towards it and the work, which we can perform, than to make its meetings successful not merely as times for delightful excursion, but for real growth in sound knowledge.

If I have been at all successful in expressing my ideas, thus far, I have given you the impression that my belief is that the greatest public health problem which looms up before us concerns the intelligent and educated rather than the unintelligent and uneducated. On a barren sandhill in the State of Maine, from the top of which the buildings of two colleges can almost be seen, is a community of several hundred

people. Their leader is a graduate of one of those colleges. I myself as supervisor of schools once engaged him as a teacher. His followers belong to the educated rather than the uneducated class. I have been told that graduates of no less than five colleges and universities are among them. They are law-abiding in general, quiet, peaceable and apparently reasonable on general subjects; but on the subject of public and private health, to say nothing of religion, they hold and try to propagate views entirely subversive in principle of all that this meeting stands for. It seems to me that there never was a time in the history of man when it was easier to start such a crusade and get followers than at present. I have a friend, of whom I am very fond, a hard-headed and successful business man, who has the firm belief that there is something in the physical condition of things which is responsible for this. He thinks that somehow the balance of nature has been upset, and he finds many, to him, confirmatory evidences of this. I almost wish I could thus lay all the blame upon nature, but I cannot help thinking that a large part of the responsibility belongs to man himself, and can and will be corrected in the slow on-moving of events. I have tried to show how we can bear some part in that correction, and it ought to be a leading part, as far as public health is concerned.

When I began I intended to make some mention, at least, of education and co-operation as applied to the ignorant public, but there is scarcely time for that. This is a very important, but as I believe a simpler matter. During this summer we have read with admiration of work along this line by certain citizens of those afflicted Southern cities, and especially by Dr. Beverly Warner, of New Orleans. Such methods are worthy of study and imitation when similar conditons arise elsewhere. I only wish I could point out as effective a means to deal with the far more difficult problem I have brought forward, but have done little or nothing to solve.

THE DOUBLE ALLEGIANCE OF THE MEDICAL OFFICER OF HEALTH.

By J. G. ADAMI, M. D., F. R. S.

MCGILL UNIVERSITY, MONTREAL, QUEBEC.

Asked by our President, and asked as a member of that University, which five years ago was the first on this continent to establish a post-graduate course and Diploma in Public Health, to open a discussion upon the importance of the Diploma of Public Health in the development of the Public Health Service, I feel myself placed in a peculiarly delicate position.

In the President's communication I gathered — and therein I imagine I was mistaken — that conditions in the United States were especially under discussion, and my remarks are especially directed thereto. Fortunately most of what I have to say may be applied equally to Canada and Mexico, and notwithstanding my mistake I am largely impenitent. For the main bulk of my audience is doubtless of citizens of the United States, and inevitably you as a body are most interested in the consideration of conditions bearing upon the development of the Public Health Service in this country.

If he cannot indulge in whole-hearted appreciation and must probe into open sores, your alien critic is altogether uncomfortable, not to say boorish. It is quite right and proper that those of the family should discuss family failings freely between themselves, but when the neighbor from over the fence calls attention to them it is quite another matter, and he deserves to "have things thrown at him."

Now it is a fact that you across the line have been discussing this matter of the failings of your Public Health Service quite loudly, and not least loudly at the meetings of this Association; and, as I say, asked to take part in the conversation, I find myself in difficulties.

Let me therefore in propitiation say at the start that we in Canada, taken as a whole, are in a worse plight than are you. It is true that, as with your States, so with our Provinces, there exist certain admirably conducted provincial departments having upon their central staffs men of most liberal views, progressive tendencies, and capacity for organization. We have, however, nothing to compare with the more progressive of your municipal boards of health. Nor can the results obtained so far by the best of our provincial organizations compare with those

gained by your State boards and notably with the achievements of this State of Massachusetts. Our rural services are in general singularly weak. By your Act of 1902 which converted the Marine Hospital Service into a Federal Public Health and Marine Hospital Service, you are far in advance of us, even if, as at present constituted, that Service does not approach perfection, and might indeed be so directed as to estrange rather than unite the Federal and State authorities.

I take it that in all institutions of Anglo-Saxon development advance is by compromise. The course offering the least resistance to advance is that which gains acceptance rather than that which is the more ideal and the more thorough. Having made this notable advance it will be possible by further compromise and successive modifications to the Act in question to obtain eventually that constitution of the Public Health Service most suitable to and most serviceable for the American people.

Rather therefore than pretending to criticize from a superior height I would place as an example to the United States, to Canada and to Mexico the conditions attained in England a dozen years ago.

Previous to 1892 the conditions in England were far from satisfactory. By the Act of 1875 the whole country, save the Metropolis, had been divided into sanitary districts, urban and rural. There was, it is true, a central authority—the Local Government Board—having supervision of health matters, but it had inadequate authority over the sanitary districts, and the urban and rural boards of health were too largely under the control of the municipal corporations and the local magistrates respectively, and in the country districts more particularly, as a matter of convenience to the all-powerful land owners, there was a too frequent tendency either to leave the appointment of the officers of health vacant over long periods of time, or to appoint some local practitioner, not on account of his knowledge of the principles of Public Health, but on account of his "pull," or in expectation that he would cause less disturbance, and accept a lower salary, than the man who had fully qualified himself to hold such a post. By an Act passed some years previously, on and after January 1st, 1902, this was markedly changed. In any country district, or combination of districts, having a population of over 50,000 no one could be appointed Medical Officer of Health unless he was a full graduate of medicine, *and was registered as the holder of a diploma from some university body in Sanitary Science, Public Health, or State Medicine*. An adequate term of years had been given to prepare for this change, and the Act establishing it had retroactive clauses so as to inflict the least possible injury on those already serving as officers of health. The law directed what should be

demanding by the bodies affording the diploma of public health. Before passing the examination the candidate should provide certificates of having taken special courses in such subjects as chemistry, with more particular reference to water, food and air analysis, bacteriology and infectious diseases, the inspection of premises and sanitary works; and the examination itself must be practical as well as written, and include also a paper upon public health legislation and regulations. The Act in short demanded special training, and that post-graduate; it created a special profession, a trained body of medical state officials.

A subsequent Act, that of 1894, revolutionized the local government of England by the establishment of urban and rural district councils, called County Councils, bodies elected distinct from the municipal corporation on the one hand and on the other the boards of magistrates, individually appointed by the Government, which had held sway in the rural districts until then. Under these county councils the control of the sanitary districts is placed. Under the new law each district council has to appoint a medical officer of health, or officers, who must not hold any other appointment, or engage in private practice without the written consent of the council. The rural county council, however, may make terms with a district urban council for the services of its medical officer, and doing this, need not appoint a special officer of its own. These medical officers of health are the officials of the county council, which has full power of appointment. Their duties to the *County Council* are clearly defined by law. I do not know that it is necessary to go fully into these duties, but briefly note that they have to report on premises dangerous to health, to inspect and report upon premises on the application of four or more householders; to inspect nuisances; may order the removal of accumulations of filth within 24 hours; may enter and inspect slaughter houses, etc.; may inspect and examine all kinds of food exposed for sale, or in the course of preparation for sale; may enter premises where animals are kept, supposed to be injurious to health, and take steps to prevent overcrowding, etc. To superintend the ventilation of factories and workshops, and prevent nuisances arising from noxious vapors in offensive trades; to take samples of milk in course of delivery — these and like matters come under their duties; while they are empowered to ascertain the course of drains, and to issue directions for cleansing and disinfection, and the abatement of nuisances; as again they are entitled to be supplied with information as to the registered deaths, and any cases of dangerous sickness of paupers — and upon these matters they have to make periodical reports to the county council.

But in addition to these duties and these reports made to the *district authority* they have certain duties towards the *central authority*, the Local Government Board, which indeed contributes to their salaries. The medical officer of health is required to inform himself as far as possible of all influences affecting the health of the district, and as to the cause, origin and distribution of disease in the district, and means of removal or modification of the same; he is required to make a systematic inspection of the district at certain periods for these purposes; he is to be prepared to advise the central authority with reference to the framing of by-laws and regulations to meet special conditions. On hearing of the outbreak of an epidemic of disease it is his duty to visit the spot and enquire into the circumstances. To go further into his duties, he has to report in writing to the central authority on the outbreak of epidemic diseases, and has each December to prepare an annual report of the sanitary state of the district in general, with tables of sickness, mortality, etc., etc., which report has to be forwarded to the central (Federal) authority.

The point that I wish here to make is that the English law recognizes and has taken steps to meet the fact, that the medical officer of health owes a double allegiance; while he is the servant of the local sanitary authority he is at the same time an officer of the federal authority, and what I would here lay down is that the only way to obtain a wholly satisfactory health service in the United States is, recognition the same fact to render practical this double allegiance.

The same necessity which has compelled matters of quarantine to be under the federal control compels the Government of the United States to have cognizance of epidemic outbreaks throughout the states for the protection of the people of the United States as a whole. Not only must immediate knowledge of such outbreaks be forwarded to Washington in order to ensure a direct common action, but the Federal Government must possess the ultimate (though not necessarily the immediate) power of stepping in and establishing regulations for the stamping out of an outbreak in any state. To the same end it follows that for the good of the whole population it must possess a general knowledge of the health conditions of each individual state and district in that state, and this it can only gain systematically by direct reports upon these matters from the several districts. Along the same lines similar direct reports are requested bearing upon birth and marriage rates, mortality and morbidity.

Now the experts capable of affording this information, which should be demanded by the general federal authority from each district, are

the officers of health of those districts. For the public weal it would be absurd to have two different sets of experts each endowed with the right to make personal enquiries regarding epidemic diseases from house to house, and armed with powers to enforce regulations and to mitigate epidemics. In other words it is essential that one man in each district accomplishes the work both for the Federal authorities and for the local authorities. The main question now is, what conditions can be laid down for the Federal and the State authorities respectively regarding the qualifications for such officers, and the jurisdiction of the same?

When we come to enquire into these matters we find that the difficulties are not so great as on the surface they would seem to be. Regarding the jurisdiction and the duties the matter is relatively simple. The medical officer of health of any district must first and foremost be a servant of the State. He must be appointed by the health department of the State, and the power of appointment and dismissal must be in the hands of that department. As regards the duties, the main work in the way of inspection and the abatement of nuisances, etc., is a State matter, or indeed is merely a local and district matter, though the State should have general cognizance of the same. As regards infectious diseases, and its prevention or arrest, the State and the Federal authorities are equally interested, and the work done for one authority would be equally accomplished for the other. As regards mortality and other statistics, those also are equally matters that concern the Federal Government and the State. The report of the officer of health made for the one body has but to be duplicated for the other, and all that can be asked of the medical officer of health is that the annual report of the general health of the district be so drawn up as to fulfill the requirements both of the State and of the Federal authorities in Washington. The Federal Government requires certain information from him, and this it must have; and further it must be assured that the information published be from an authoritative source.

The only practical way by which, short of possessing the power of appointment, the Federal authorities can assure themselves that the medical officers throughout the states are trained and competent is by their demanding that those appointed as medical officers shall have had the full special training requisite for the performance of their particular duties. And the only practical way by which they can assure themselves is by their laying down regulations as to what shall constitute a proper training. What is more the routine information required from one end of the country to the other being identical, the standard and the qualifications for all the states in the Union must be identical. In other

words the matter of prescribing what shall be the training and what shall be the examination standard of future medical officers of health is pre-eminently a Federal concern. It by no means follows that the central government should itself afford that training, or that there be one portal of entrance through an examination held at Washington. That is unnecessary. There are numerous centres — centres in every state — at which by the co-operation of the universities and the state boards of health the necessary teaching, didactic and more particularly practical, can be afforded. Each state, indeed, could and should train its own men. But when, as at the present, one state of this Union possesses no less than sixty-five separate bodies having the privilege of granting the degree of LL. D., it is obvious that the degrees granted by all the sixty-five are not of equal value — that some, indeed, are a trifle discreditable. Thus under this scheme the Federal authorities should be empowered to select or to recognize the courses of training afforded by certain universities only. Or what comes to the same thing, but involves less interference on the part of the Federal authorities with State prerogatives, the act should lay down that the health department in each state shall itself select some one or two universities with which to co-operate in establishing a course for the training of its health officials.

I urge therefore that the next step to be taken in the advance of the public health service in this country is the passage of an act which shall render it obligatory throughout the Union that on and after a certain date no one shall be appointed medical officer of health who cannot present a diploma from some recognized teaching body showing that he has passed a satisfactory examination, written and practical, in the subjects of Public Health and State Medicine — the course of training and the scope of the said examination to be laid down in the said act. Following the lines of the English Act, this act should contain retroactive clauses to the effect that those who had been medical officers of health above a certain number of years should be confirmed in their positions — should not be required to present themselves for examination, and that those appointed within a certain number of years before passage of the Act might be required to present themselves for examination and to present the diploma before a certain date.

A further clause in such an act should deal with the subject of stipend. In England the central and the local authorities contribute half and half. Here the conditions are very different. England, strictly speaking, is in the position of one of the constituent states, not in that of the whole Union, and the scheme here outlined demands that the medical officer of health of a district affords to the Federal au-

thorities at Washington what is little more than a duplication of what he has to afford to the central board of health of his state. Nevertheless in so doing he performs an essential service to the Federal authorities — a service which failing him could only be obtained by them at a very serious expense. Probably the simplest method whereby Washington could acknowledge its indebtedness to the public health services of the different states would be by granting a subvention towards this end to the Public Health Department of each State.

As an alien, ignorant of the finer play of public feeling on such matters it may be, ladies and gentlemen, that like the alien St. Paul addressing the Corinthians, I speak as a fool; if so, judging from the way in which you have received these remarks, and remembering that we are in Massachusetts, again quoting that same authority I cannot but feel that you suffer fools gladly.

One objection I see to this scheme, namely, that it presupposes that the different states are already divided up into districts, having a population of 50,000 or more, each possessing a medical officer of health. This cannot be the case everywhere. A clause therefore would be necessary directing that the State Board of Health should be responsible for notifications of outbreaks and annual reports regarding such areas of the State as are not provided with duly appointed officers of health.

Another objection is, that such a scheme wholly upsets the present method of appointing the health officers in the various states. If I understand matters aright there is at present in most states a multitude of health officers for small districts, untrained and receiving nominal stipends. I think we will agree that qualified health officers, well paid, are everywhere requisite. The appointment of such officers for each county or combination of counties having a population of not less than 50,000 is of supreme importance, and for groups of this size the State can afford to allot reasonable stipends. I will only say that this has come about in England — so sought after are good health officers that when a few years ago we thought of approaching certain promising men in England to offer them the position of Professor of Hygiene at McGill University we were informed by more than one of our advisers there that the stipend we could offer — and it was respectable — was not sufficient; men could make more as district health officers. Such an act in short would lead to competition to obtain the best men, and stipends would inevitably increase.

Yet another, and at first sight weighty objection, would be, I imagine, that as State officials, the medical officers of health are liable to be dispossessed at each change of administration. Instead of this being an objection it is the very reverse — that is, if we believe that it is to the

advantage of the country to be possessed of an able and a stable body of medical health officials. This very demanding that the officer of health possess a diploma of public health cuts out from the service the mere political opportunist. If the post is to be a political nomination no one would trouble to give himself the better part of a year undergoing special training for the same on the chance of being turned out of office three or four years hence. In other words, demand a diploma of public health for and from the present possessors of these posts and there will be none to oust them. The creation of a special service will ensure stability of office.

In conclusion, ladies and gentlemen, I trust that nothing that I have said will have seemed to throw cold water upon the advance recently made in the establishment of the Public Health and Marine Hospital Service. That was a great advance, and as an outsider I regard as its first feature the clause in the act empowering conferences between the Federal and the State health officials, provided always that those conferences be so conducted as to permit the freest interchange of opinion. The good spirit that has thus developed between the two bodies has already in Louisiana and elsewhere borne rich fruit. It is this advance, indeed, wise and timely, which permits that you in this country look forward to still greater progress, and, as I have said, that, in my opinion, is to be looked for along the lines here indicated of still further unification of Federal and State health authorities, and yet fuller recognition of the Public Health Service as a distinct profession through the establishment of a diploma of public health.

APPENDIX.

To indicate what in our opinion is a practical course for a diploma in Public Health on this Continent, and what are the primary requisites, it would seem well to append the main regulations of the course demanded by the McGill University:

Candidates undertaking this course must have possessed a degree in Medicine or other qualification of practice for at least twelve months before the candidate is competent to receive the diploma. The following are the courses requisite:

1. Course of lectures in Public Health (to be omitted in the case of candidates who have attended such a course before graduation).
2. A three months course of instruction upon infective and parasitic diseases of men and the domestic animals, which course shall include practical work in a bacteriological laboratory.
3. A six months course of practical study of outdoor sanitary work under a Medical Officer of Health (to be omitted in the case of Medical

Health Officers holding appointments prior to the establishment of this diploma course).

4. Three months attendance and clinical instruction at a hospital for infectious diseases (unless such course has already been taken prior to graduation).

5. Three months instruction in sanitary chemistry and physics with practical work in a chemical laboratory.

The examination for diploma shall cover the following subjects:

1. Examination of clinical cases at an infectious hospital.
2. The drawing up of outlines for annual and other reports of Officers of Health.
3. A report upon the sanitary condition of some actual locality.
4. The chemical analysis of liquids and gases and of specimens of food.
5. Demonstrations of the consideration and use of meteorological, hygienic and sanitary apparatus.
6. Microscopical examination of specimens submitted.
7. Description of specimens of human and other diseased tissues.
8. Practical examination in the employment of the usual bacteriological methods.
9. The inspection of carcasses of animals to be used for food.

The above examination shall be written and oral and practical and shall extend over a period of four days.

The following is a list of subjects included in the curriculum of study:

(a) *Sanitary Chemistry*, Examination of air, gases, water, the action of water on metals; milk and food; detection of poisons in articles of dress and of decoration; the chemistry of sewage.

(b) *Sanitary Physics*, Hydrodynamics, pneumatics and hydraulics applied to hygiene, light and photometry; heat and thermometry; the principles of hygrometry.

(c) *Sanitary Legislation*, Statutes and by-laws relating to public health, the powers of public sanitary authorities.

(d) *Bacteriological and Parasitological*, Modes or propagation of disease and transmission of disease between man and man, and man and animals; bacteriological analysis in relation to public health matters; natural history of microbes and animal parasites.

(e) *Vital Statistics*, Calculation and tabulation of returns of births, marriages and deaths and diseases.

(f) *Nosology*, Definition in nomenclature and classification of disease.

(g) *Meteorology and Climatology*, The geographical and topographical distribution of disease.

(h) *Preventive Medicine and Practical Sanitation*.

PRESENT REGULATIONS OR LAWS AS TO QUALIFICATIONS AND METHODS OF APPOINTMENT FOR (a) EXECUTIVE, AND (b) TECHNICAL HEALTH OFFICIALS.

BY SAMUEL H. DURGIN, M. D., BOSTON, MASS.

The part assigned to me in this general subject, required information from the several states of the Union. I therefore addressed letters of inquiry to the secretaries of the State boards of health, and received answers from thirty-four of the forty-eight states.

In these answers I find that in the executive branch of the health organizations, physicians are required by law as health officers in fifteen of the states. In two states, Kansas and Connecticut, their laws require that the physicians so appointed shall have knowledge of sanitary science. In one state, New Jersey, the law empowers boards of health to examine applicants for license as health officers, but without indicating any line of inquiry in the examinations.

In the technical branch of health organizations I find no account of any law or regulation concerning the appointment or qualifications of technical officers in any of the states heard from.

I have known applicants for technical work in laboratories in this state to be required by the appointing board to take a competitive examination before a competent body selected by the appointing board. This, however, was without law or regulation. It was simply agreed upon by the contracting parties.

It is not uncommon to require a civil service examination of considerable import for sanitary inspectors, who are not held to direct any work or to decide any questions of sanitary procedure, while the health officer, who must frequently act in a semi-judicial capacity on sanitary questions, may be appointed with no reference to any special qualifications.

LAWS CONCERNING TEACHING HYGIENE.

BY DR. HELEN C. PUTNAM, PROVIDENCE, R. I.

It has recently been my work in another medical society to compile and analyze our present laws relating to the teaching of hygiene, 45 state and 1 Federal, all more or less elaborated. This time-consuming task was undertaken with ideas that I have been compelled to alter radically in the progress of the study. My anticipations were based upon certain general — somewhat pessimistic — statements in lay, scientific and medical current literature; but the exact details that I now lay before this distinguished assembly of sanitarians should be known to all physicians interested in that magnificent side of our calling, *preventive medicine*. In our sessions on pure water supplies and on fighting contagions one realizes that “magnificent” is literally descriptive: “doing great works of goodness.” It is not my intention to discuss this legislation further than to give the facts as they stand in the present laws.

The laws existing in 1903 (none have been altered since then) are published in the Bulletin of the American Academy of Medicine for April, 1904, as a preliminary report of the committee to investigate the teaching of hygiene in public schools. The details of all the statistics I shall give can be found in appendix A of the first installment of the committee's report published in the Bulletin, June, 1905.*

It is well known that the initiator of public sentiment that has resulted in this legislation extending over all territory under our jurisdiction, was the Woman's Christian Temperance Union. Its immediate aim has been and is to have hygiene in connection with instruction as to the nature and effects of alcohol, tobacco and other narcotics, taught on a scientific basis in public schools as thoroughly as is arithmetic or any other branch required by law. We find accordingly in all the laws the phrase “physiology and hygiene with special reference to the nature and effects of alcoholic drinks and other narcotics.” There are several variations in this wording the reasons for which it is not necessary to discuss at this time. The general interpretation of this clause is that physiology and hygiene shall be taught, including the special topic indicated.

The nine other chief details occur irregularly, most of them appear-

* Address Dr. Charles McIntire, editor, Easton, Pennsylvania.

ing first during the five years after the original law of 1882 in Vermont. Their *raison d'être* is that it seemed necessary to specify them in order to secure enforcement of the spirit of the law. Any physician who has had experience in our political methods can easily imagine the evasions these laws have met, in consequence chiefly of the opposition of one of the largest commercial interests, as well as from certain social influences; from the indifference or ignorance of many, and from teachers' lack of preparation for teaching science. Without going further into their history let us now examine these nine legal specifications:

1. *Specifications concerning what schools shall teach hygiene.*

The Federal law specifies all public schools, including Indian and colored, in the territories and District of Columbia, and military and naval academies.

Twenty-three state laws specify "all public," ("common," "free") schools."

Twenty-two specify "all schools supported wholly or in part by public money, or under state control," Illinois and New York adding all normal schools, teachers' training classes and institutes, and schools connected with reformatory institutions. Private schools having special charters are "under state control," but the law is not generally interpreted to include them. The law of Michigan, however, specifies all such schools, and the law of Massachusetts all private day schools except those solely for instruction in particular branches. Alabama specifies colleges; Indiana, Maryland, Minnesota, Ohio, Pennsylvania, Utah and Wyoming specify "all educational institutions" aided by state funds. This would include state universities, colleges and normal schools; certain institutions for study of special subjects; schools for defectives (blind, crippled, deaf mute, feeble minded); schools for the neglected, destitute and incorrigible; schools in reformatory and penal institutions. I do not know how literally these seven laws are enforced. As a matter of fact, many of the 22 laws specifying simply "public schools," are interpreted to include normal, reformatory, and some others.

This detail of the 46 laws differs little anywhere in actual intent, and the same is true of the next.

2. *Concerning preparation of teachers.*

Fifteen states have only the general school law requiring examinations of teachers in all subjects ordered by law to be taught. Thirty specify examination in this branch as in others, Idaho excepting primary teachers; New Jersey, teachers of music, drawing, manual train-

ing, etc. The Federal law does not mention examination of teachers in military and naval academies.

3. *Specifications as to what pupils in these schools shall receive instruction.*

Fourteen laws do not specify what pupils shall receive this instruction, and 23 specify "all pupils." California specifies all grades, in all classes, during entire school course; Connecticut, "above third grade and below high school;" Illinois and New York, "below second year of high school;" New Hampshire, "above primary grade;" South Carolina, "as far as practicable."

This detail as to teaching hygiene in primary and grammar grades is influenced by the fact that in round numbers out of 5 million pupils entering the lowest primary grade only 1 million go on to grammar grades, and only one-quarter of a million enter high school. Nineteen-twentieths of the pupils, and they of the poorer classes, would receive no instruction in hygiene if it were confined to high schools; sixteen-twentieths, none if it were confined to grammar schools.

4. *Concerning methods and thoroughness of instruction.*

Fourteen laws make no specification as to whether the instruction shall be oral or by text book. Nine laws specify "text books in the hands of pupils;" nine specify text books for those able to read and oral instruction for those unable to read. California and Indiana require oral instruction only, but in fact have text book instruction also.

Twenty-five laws specify that instruction shall be as thorough as in any other branch required by law.

5. *Specifications concerning text books.*

Fourteen laws only out of the 46 make specifications concerning text books.

Eight of these specify that they shall be approved by certain authorities; North Carolina, by the state text book commission; New Hampshire, by the superintendent of public instruction; Nevada and Michigan, by the state board of education. Michigan's original law (1883) also included approval by the state board of health. This has been eliminated, and now Wisconsin is the only state requiring approval by its health officials. Minnesota requires approval of text books on hygiene by the superintendent of public instruction and presidents of normal schools; Colorado, by the board of directors of the school district.

Four laws specify the minimum number of pages for instruction as to the nature and effects of alcoholic drinks and other narcotics.

Illinois, Michigan, New York and North Carolina require at least twenty pages in high school volumes, i. e., about one-twentieth of the

volume. Below this grade Michigan and North Carolina require at least one-fourth of the volume; Illinois and New York, at least one-fifth, also adding that the pages in a separate chapter at the end of the book shall not be counted in this minimum. This provision was introduced, it is stated, to discourage the attempt to place in the schools old text books to which a "temperance appendix" had been added to conform with the law requiring instruction in hygiene to include instruction in this special subject.

For the same reason the laws of fourteen states specify that temperance instruction shall be given "in connection with the several divisions of the subject of physiology and hygiene;" i. e., that when studying the circulation, or the nervous or respiratory systems, pupils shall at that point be given instruction as to the effects of alcohol and other narcotics upon each.

The laws of two states, New York and Illinois, specify that text books shall be graded to the capacities of pupils of fourth year, intermediate, grammar and high schools.

6. *Concerning time to be used for instruction.*

Three only out of 46 laws have specifications concerning length or minimum number of lessons in hygiene.

North Dakota has a minimum for oral instruction to those unable to read; at least 15 minutes daily, 4 days each week. This means an hour's weekly instruction in hygiene including temperance, or a possible 24 hours yearly, the minimum school year being six months.

Illinois and New York in the lowest three primary grades require respectively 3 and 2 lessons each week, each year. If these are 15 minutes long, they amount to $7\frac{1}{2}$ hours and 5 hours oral instruction yearly for three years.

Illinois and New York require for text book instruction 4 and 3 lessons weekly, respectively, for 10 weeks each year, from the fourth primary year to the second year in high school. Text book lessons are usually 20 minutes. This amounts therefore to a minimum of $13\frac{1}{2}$ and 10 hours yearly for six years; somewhat less for eleven-twelfths of the pupils who do not go through all grammar grades nor continue in high school.

We see from the above that the greatest requirement of any of the three laws is 24 hours minimum oral instruction yearly in physiology and hygiene, including temperance instruction; the other two states not exceeding a minimum $13\frac{1}{2}$ hours for either oral or text book teaching. The usual minimum time given to either reading and writing, geography or arithmetic is not far from 40 hours yearly. Therefore the laws of Illinois, New York and North Dakota cannot justly be

said to make undue claims for the subject of health. Certain other states in some schools give even more time to the subject.

7. *Pupils' examinations in hygiene.*

Illinois, Iowa, Ohio and New York specify that pupils must pass the same tests in this as in other branches.

8. *Enforcement of laws.*

A law whether good or bad is not infrequently futile because no one is interested in enforcing it or because, if interested, he has no means of overcoming the hostility or inefficiency of some official. Experience has proven the wisdom of providing a model law with three powers. The duty of enforcement must be definitely placed, the method of enforcement detailed, the penalty for non-enforcement indicated, and provision for complaints is sometimes made. In the legislation under discussion experience seemed to indicate that these provisions were sometimes desirable.

The duty of enforcing these laws is specifically assigned by 31 states, usually to certain local school authorities, occasionally adding the state superintendent or county board.

9. *Reports, and penalties in case of non-enforcement.*

Special reports from special sources are stipulated by 13 laws. They may be from teacher or other local official, or from any citizen or head of family, to some local or state official, or by the state superintendent in his annual report to the public. The report is frequently made to the official who pays out school money.

Penalties for non-enforcement of laws are specially mentioned by 19 of these states. They vary from removal of any guilty official from office, or revocation of teacher's certificate temporarily or otherwise, to loss of salary, or fines from \$5 to \$200 against any guilty official, or loss of all or part of state appropriation to school, city or district.

Delaware and Washington specify the officer of the law who shall recover the fines. Ohio and Washington specify what shall be done with said fines.

In states where no special mention is made of the enforcement of this law there is the general school law requiring teachers' compliance, subject to dismissal, etc.

I now beg to call your attention to the opportunities which these laws offer for the introduction of any alterations in the present teaching of hygiene. You will observe that—

1. No law states what shall be taught as to the nature and effects of alcoholic drinks and narcotics; nor that total abstinence shall be taught.

2. No law prevents the teaching of hygiene through "domestic science," physical training, biology, medical inspection; nor from other view points than physiologic, as economic, or sociologic. All these methods have begun and are progressing along with our growing acquaintance with the subjects.

3. No law requires indorsement of text books by the Woman's Christian Temperance Union.

4. Forty-two laws do not stipulate the space for temperance instruction in text books on hygiene. Forty-three laws do not specify number and length of lessons in hygiene (including temperance).

Or, in other words —

These laws, making the study of physiology and hygiene mandatory, as are other essentials of common education, provide opportunity to introduce text books, methods, teachings, for any interested in hygiene who have the capacity to do it. They evidence in their details the intention that *so far as law can secure it* the teaching of health shall be on a par with the teaching of mathematics, language, and physical environment. Certainly it ought to be. The laws are not hindrances, but proffer openings — more than proffer — they command the work to be done.

It is not the province of this paper to discuss the kind of work now doing, nor the kind of work that ought to be done, nor how a change if desirable can be effected; but whoever wishes to make a change must accomplish it not by expending vitality and time in altering laws, but by convincing school authorities that some other text book or method will produce better results than those already in use.

SANITARY CONFERENCES AND SCHOOLS OF INSTRUCTION.

By HERBERT D. PEASE, M. D., ALBANY, N. Y.

It has been aptly said by one of the members of this Association, that it is given to but few men to actually alter or divert the general current affairs in any particular line of endeavor.

In considering the future possibilities of certain aspects of the work of the State Department of Health with which I am associated, it was deemed wise therefore to study the general trend of sanitary affairs in other states in these matters, and to adopt plans for our own future development in a manner as consistent with the general course as our peculiar conditions would permit.

For this and other reasons a survey of certain of the policies of the various state boards and departments of health was undertaken and a series of questions sent to the executive officer of each.

Replies were received from thirty-one states, including all but a few of those having well organized departments.

The line of inquiry was directed toward the relation of the state boards to the local health officials, the powers of the central office of appointment, removal, and fixing of the qualifications and compensation, of the local officials, and also more particularly to the means which the state authorities were taking to keep the local officials in close touch with the work of the central office and with the scientific development of public hygiene.

Leaving the questions of appointment, removal, compensation and required qualifications of these officials largely for others to present to you, I desire to report the results of the inquiry into the means of bringing to the local official such facts and knowledge as will enable him to properly perform the ever-growing, and sometimes rather arduous and often thankless tasks which he is obliged by law and regulations to undertake.

It was assumed in advance that every state board, or department, is obliged by the power or law creating it, to report to that authority its doings, either annually, or bi-ennially. While such reports are usually distributed to the local health officials amongst others, they are sent out at periods varying from a few months to several years after the occurrence of the recorded activities. The necessary character of such

a report, as a detailed record of local activities, renders it in most instances therefore, a hopeless method for imparting the information most needed by the local officer and his constituents.

Of the thirty-one states sending replies to the questions mentioned, in eight there are no publications issued other than regular reports; in six, only, circulars dealing with the various infectious diseases are distributed; in seventeen, bulletins or special reports are issued, of which seven also issue circulars, but in seven the bulletins are merely statistical records. There are fourteen states which regularly issue either instructive circulars or bulletins containing original papers, abstracts of sanitary literature, laboratory reports and other valuable information for the benefit of local health officers and the public. In each of these fourteen states the expense of publication and distribution is borne by the state, and that those receiving the reports appreciate their value was claimed by the reporter for each of these states.

The form in which the instructive matter is placed before the local officials and their constituents varies within wide limits, as is indicated by the figures given. This can be accounted for largely on the ground of custom and the individual opinions of the state officials rather than on account of geographical, or other local natural conditions.

While a detailed study of each form would be of interest, the various types can be grouped into three classes, namely, the circulars, the monthly or quarterly bulletins and the annual conference reports.

As has been stated, six states issue circulars exclusively. There can be no denying the great value of the widespread distribution of properly prepared circulars, each dealing in a succinct manner with the etiology, modes of transmission, and the methods and means of treatment and of prevention of a particular infectious disease.

Such information should be issued by every state board, or department of health. The ultimate destination of these circulars should be the general public, and this fact should be constantly kept in mind during their preparation.

It will hardly be questioned, however, that there is much information which the local officials require from the state boards which would be but little comprehended, or of interest to the public at large. Moreover, as the science of public hygiene advances, it becomes progressively more difficult for the local health officer to keep posted on the very lines of work with which he is expected to be especially familiar, unless some special aid is given him.

While the weekly and monthly medical journals have contained large amounts of literature on public hygiene, scattered throughout a maize of clinical subjects, it is not possible for the majority of health officials

to become acquainted with even a small fraction of it. Moreover, while there is an increasing spirit of welcome toward the millennium of real preventive medicine, it cannot be denied that the present energies of the majority of the medical profession are, and must be, directed chiefly towards the interests of the patient under treatment and not towards the welfare of the public at large.

As this condition also dominates medical literature, it is not to be expected that the practitioners who make up the larger body of local health officials will become acquainted with the important advances in our knowledge of public hygiene without assistance. Some special provision must be made for their instruction, and as a means towards this end we have as examples the excellent system of either monthly or quarterly bulletins of some of the more progressive state boards of health, of which those of Vermont, New Hampshire, Ohio and Indiana are excellent examples.

I do not desire to convey the impression that other states have not accomplished much by the distribution of annual reports, of which the most noteworthy example are those of the State Board of Massachusetts; nor that the special distribution of reports of the proceedings of the state public health associations, and of conferences and schools of sanitary officers of the states of Michigan, New Jersey, and New York amongst others, have not accomplished much in the way of instruction.

However, such reports containing as they do long papers and discussions, may be looked upon as of value chiefly as works of reference. Literature intended for conveying instruction for immediate use will usually fulfill its purpose to a degree inversely to its length.

Short original papers, condensed abstracts of important subjects on public hygienic questions, statistics with short explanatory notes, notices of interesting court decisions and other rulings, and other condensed material which can be readily read and understood, will be best adapted to the needs of the local official who is usually a busy practitioner of medicine with but snatches of time at his disposal for the improvement of his training in sanitary science.

Some few of the bulletins now being issued are already, in their youth, showing a tendency to over production in the way of long addresses and papers, and extended wordy discussions frequently, but not always, of but little value as a means of instruction.

It can hardly be questioned that a system of carefully prepared abstracts of papers by subjects, each series dealing with a special line of hygienic work, written by one especially familiar with that branch,

would be an ideal method of presenting those subjects to the busy man who cannot possibly hunt out and read the originals for himself.

As yet but few of the state boards, or departments, of health have at their command specialists in all of the varied branches of public hygienic work, and for the publication of a bulletin covering every field those states must necessarily depend somewhat on the abstracts of others. Would it not be possible, therefore, by a system of co-operation or division of labor between the various state departments to make available for each state a complete set of uniform abstracts on each subject of common interest and importance, and thus save the reduplication of an immense amount of necessarily careful and painstaking work.

Such abstracts could, of course, be entirely supplementary to the publication of other material of more local interest and importance in the completed bulletin of each state.

Without entering into a detailed consideration of the merits or the many difficulties inherent in the inauguration of such a clearing house for the literature of sanitary science and public hygiene, let me ask those of you most interested in this matter to picture to yourselves the enormous multiplication of our efforts, which shortly may be represented by thirty odd sets of monthly or quarterly bulletins, all dealing with the same general lines of work in very much the same manner. Let us ask ourselves if now is not the time to consider the development of some system which will not only give us a better prepared material for publication but prevent an undue waste of our energies.

Without detracting from the undoubted value of the properly prepared bulletins as a means of instruction for the local health official, and indeed for all of us, can even an ideal bulletin be considered as completely filling the existing need for such instruction?

Of the thirty-one replies to the question concerning the qualifications required by local health officers, one did not give a definite answer; eight stated that there were no specified legal requirements; nineteen stated that the officer must be a physician; two, that in addition he must have experience in sanitary matters, and in only one state is a special knowledge of sanitary science, and a certificate to that effect, required of candidates for these positions.

It is not necessary to emphasize before this Association the need of special training or experience for the proper conduct of sanitary affairs by the health officer of even small, or thinly populated, regions, to say nothing of those having supervision over cities and large villages.

The subject of the teaching of hygiene and the granting of degrees in public health by medical colleges and universities has been ably

presented to us in the reports of past committees, especially that of 1901, and particularly so by Drs. Ernst and Adami to-day. However, can we expect any marked influence in the very near future from this source on the character of the appointments to the fifteen thousand and over health officerships which will be filled during the next few years?

Undoubtedly those few universities with endowments sufficient to warrant the undertaking, and those others which enjoy a liberal state support, and are also in close touch with their state boards of health, will in time inaugurate such courses in hygiene and sanitary science, but the inducement for the average medical school or university to undertake such work is not over great as I have learned in a few instances from personal experience.

The pressure for the time, and greater facilities for preparing their students for the future struggle with the individual patient rather than for the betterment of the public at large, is too great for most medical schools to warrant much expenditure of money and effort for courses in public hygiene. Unquestionably state boards and departments will be compelled by the course of events to accept the opportunities presented to them to assist the local health official to a fuller knowledge of sanitary science and his own special duties.

Ninety-five per cent. of such officers are physicians, and a large proportion of them have held their positions for several years, and are familiar with the practical aspects of their work. A large number of them are more than willing to receive any possible additional training and experience, providing they do not have to make too great a sacrifice to obtain it.

As an *immediately* available method for the development and improvement of the work of both the state and the local boards of health, the holding of conferences and schools of instruction seems to me to present an opportunity which might well be still further cultivated.

A study of the replies of the thirty-one states to the questions submitted to them shows that in four there are public health associations, all but one of which are independent of control by the state board of health; in ten there are conferences of sanitary officers or schools of instruction, under state supervision and control; in six, the institution of such organizations is either being considered or already projected, and in only eleven states are there neither such organizations, nor any thought of their establishment.

In general the association differs from the conference and school in that it is independent. While it has the advantage of greater freedom, it loses to some degree in its value as an instructive agent to the

health officer. Its very independence also involves the question of membership fees for its running expenses, and the preparation and distribution of its reports.

That the independent associations accomplish a most valuable work is true, but that they do not cover exactly the same ground, or take the place of the schools and conferences is indicated by the fact that in New Jersey, which has the oldest and one of the most active and progressive of the public health associations, the state board is considering and urging the establishment of a conference as well.

The distinguishing feature between the conference and the school seems to be more a question of compulsory attendance rather than a difference in actual management or material presented. In the three states in which the schools of instruction exist, the attendance of the local health officer is required by law, and in two of them the municipalities represented are furthermore obliged to pay the expense of such attendance by their representative. In eleven other states the municipalities can legally pay such expenses if they are so disposed. In the bill drawn by the State Board of Health of New Jersey providing for the establishment of a conference of state and local sanitary officers, the expense of compulsory attendance was to have been a state charge.

In the matter of time and place of the meetings the majority of the conferences and schools are held annually, and at the state capitol, although these matters are usually at the discretion of the state boards.

The voluntary associations are as a rule older in years than the conferences and schools. The latter are of comparatively recent development, the majority not having held over four annual meetings.

The proportion of the local health officers attending the conferences naturally varies with the requirements as to attendance, but a fair average of those in which it is compulsory would be nearly eighty per cent., while in those in which it is not compulsory would be twenty-five per cent.

The question might well be asked as to how many of even the most prominent and successful medical societies have a larger rate of attendance at an annual meeting than the average of twenty-five per cent. for the non-compulsory conferences.

There can be no questioning the present popularity of these conferences and schools with most of the state and local officers. In some few instances the rate of attendance indicates a lack of interest, but this may not be due to any fault in the general plan.

The local officials must obtain something worth while coming for, or even compulsory attendance will not avail. The meeting must be productive of either a clarification of the officials' present knowledge,

or a definite increase of their stock of new facts. Above all it must be stimulating in its tone and character, and for this purpose nothing is more conducive than freedom of discussion.

Topics in sanitary science in their executive, legal, technical, and even political aspects should be brought up and freely discussed. Opportunities to visit any unusual and well established public work of a sanitary character might well be provided.

From the character of the replies, it can be stated that the value and possible development of these institutions is becoming more and more apparent to the state officials, and that their future is certain, providing the proper efforts are not lacking for making their work more and more attractive.

With the development of the various laboratories and technical departments of state work will come opportunities for the actual demonstration of many of the methods there employed for assisting the local officer in his work, and to those previously unfamiliar with them such demonstrations will mean much.

If the technical branches of the state work are conducted in either a state or private teaching institution excellent opportunities then exist for a material widening of the scope of the school of instruction by including laboratory courses in the technical branches of public health work. Undoubtedly many difficulties would be encountered in adopting such a course, but it is doubtful if they are insurmountable.

The State of New York, realizing that it was not reasonable to expect medical schools and other institutions to undertake to give technical instruction in highly specialized fields of medicine, has maintained for several years a somewhat analogous school in connection with its State Lunacy Commission. The medical officers of its state hospitals are obliged to present themselves at regular periods for general and technical instruction and training in psychiatry and neuro pathology at this state laboratory. To the ambitious health officer seeking for opportunities for post-graduate training the privilege of attending such a school of instruction would be welcomed. Even when the time arrives that all appointments are made from among those who have had a special training in hygienic and sanitary science, the necessity for continued instruction will not cease, if such officials are to keep abreast of the full requirements of their work. Inducements such as the free distribution of high grade bulletins and the privilege of attending schools of general and technical instruction will tend to make these positions far more desirable, and will result in their being more eagerly sought after than at present.

In some states legislatures are materially increasing the duties of the local health officials along the lines of tenement house inspection, building permits, and the child labor reforms, and in such it becomes the duty of the state to in some way adjust the compensation of these officials to their increased duties. In what better manner could such return compensation be given than by making their work more attractive and more satisfactory because of the strong support and the new experience to be obtained by cordial and close co-operation with the state and sanitary officials on some such lines as those outlined above?

THE WORK OF THE HEALTH EDUCATION LEAGUE OF BOSTON.

By HENRY J. BARNES, M. D., BOSTON, MASS.

The Health Education League of Boston was organized in the spring of 1904 for the purpose of disseminating, chiefly among wage-earners, modern scientific knowledge relative to the preservation of health. Doctor Dudley A. Sargent, of Cambridge, is the president, Rev. George H. Cate, the secretary. A vice-president, a treasurer and a board of nine directors include the officers of the league. Any person interested may be elected a member on the payment of an annual due of one dollar, and at the present time we have a membership of about one hundred and fifty.

We strive to reach the wage-earners through their various organizations, by lectures and practical talks by competent persons, and by the distribution of literature compiled from our best authorities on hygiene and sanitation.

What we have accomplished is impossible to measure other than by the interest manifested in a demand for our speakers fully equal to our ability to supply, and demand for our literature to the extent of more than 20,000 copies — which in many instances have been sold for enough to cover the cost of printing. Philanthropic motives have governed in some instances their distribution, but many have been purchased by employers of labor who appreciate the value of healthy employees.

Our booklet entitled "Hints for Health in Hot Weather" gives instruction in the care of food, in cleanliness, in clothing, the healthfulness of out-door air both night and day and the beneficial influences of sunlight. The breeding places of flies and mosquitoes are pointed out, and why exclusion of both from our homes protects from disease.

Doctor Charles Harrington has prepared for us a booklet on "Milk." From production to consumption its sanitary requirements are set forth and its food value when these requirements are fulfilled. It is unnecessary for me to more than mention the authors' names as evidence of good suggestions and advice.

"Colds, and their Prevention," compiled by officers of the League, advises on measures for protection in cold weather, excessive artificial heat, absence of sunlight, deficient ventilation, and the transmissible character of the diseases of respiration, are among the subjects con-

sidered. Mrs. Richards prepared a booklet on "Meat and Drink." In simple but attractive language she gives food values, methods of preparation, and economic principles governing its use.

Sample copies of our literature can be obtained by addressing the Secretary, Rev. George H. Cate, 113 Devonshire St., Boston.

GRADUATE AND UNDERGRADUATE INSTRUCTION IN HYGIENE IN UNIVERSITIES AND MEDICAL COLLEGES — SPECIAL DIPLOMAS IN PUBLIC HEALTH.

BY PROF. H. C. ERNST, BOSTON, MASS.

The Association has itself on several occasions, through the action of its committees, taken the position that some systematic instruction in public health should be offered. Of this there can be little doubt, but in discussing the practical question of how it should be done, or by what bodies it should be offered and regulated, many perplexing points arise.

In England, the same difficulties do not occur. There is there a central examining body before which must appear all persons desiring to receive degrees making them eligible for certain lines of work. There is also a body, competent to set a certain standard of knowledge, to which all persons wishing to engage in public health work must attain. How this works out in practice is very well shown by the current announcements of the University of Liverpool for the academic year 1905-1906.

This University has two departments connected with our subject. First, the School of Hygiene, under the direction of the Liverpool Sanitary Science Instruction Committee, that issues a prospectus and arranges courses of lectures and demonstrations on Sanitary Science. These are "especially arranged for persons desirous of qualifying as sanitary inspectors, but are also open to all interested in the subject of hygiene."

The announcement says, "In order to meet the requirements of a constantly increasing number of candidates wishing to qualify for these posts (Health Inspectors) in Liverpool and other large towns and rural districts, the Sanitary Science Instruction Committee, in which is represented the city council and the University of Liverpool, has designed classes for the purpose of providing the necessary instruction in these subjects. These classes are arranged so as to be of a practical character, suitable for those wishing to attain one or more of the various certificates in sanitary science, but they are also adapted to meet the requirements of builders, surveyors, architects, and others interested in sanitary science. *The course of instruction given is recognized as sufficient training by the Board of Examiners of the Sanitary Inspectors' Examination Board and the Royal Sanitary Institute.*"

This first department then makes provision for the proper training of

the subordinates concerned in public health work. Its success is dependent upon the fact that all such subordinates must have received a "Certificate of Sanitary Service" — which certificate can only be obtained after examination. There is, therefore, a force compelling persons wishing such employment to resort to systematic training for it, but such compelling force does not exist in this country.

The second department of the University of Liverpool, to which I have referred, is the "Department of Public Health" under the Faculty of Medicine. The instruction given herein is more thorough and extended, and is of a different nature to that of the first. It was established under an ordinance as follows: 1. The University shall grant a diploma in public health (written D. P. H.), which shall be awarded in pursuance of a resolution of the senate. 2. This diploma shall be awarded only to candidates who pass the prescribed examination, and candidates before entering for any part of the examination (1) must have held for not less than twelve months a registrable qualification in medicine, surgery and midwifery; (2) must present satisfactory certificates of having attended approved courses of study. (3) Regulations shall determine (a) the periods and courses of study; (b) the subjects of examination; (c) the fees to be paid for examination.

Of the "Regulations" only that part relating to the requirements of candidates for examination is of interest to us at this moment. They read: 3. Candidates before entering for either part of the examination must present satisfactory certificates

(a) Of having attended, during at least three months, an approved course of instruction in public health in the University.

(b) Of having attended, after obtaining a registrable qualification, during at least six months, practical instruction in the laboratories of the University in chemistry as applied to public health, bacteriology, and the pathology of the diseases which are communicable to man.

(c) Of having, after obtaining a registrable qualification, attended during not less than three months, the clinical practice of an approved hospital for infectious diseases.

(d) Of having, after obtaining a registrable qualification, during six months (of which at least three months shall be distinct and separate from the period of laboratory instruction required under b) been diligently engaged in acquiring a knowledge of the duties, routine and special, of public health administration under the supervision of a medical officer of health, who is also a teacher in the department of public health of a recognized medical school; or (1) in England and Wales, the medical officer of health of a county, or of a single sanitary district having a population of not less than fifty thousand, or a

medical officer of health of a county or counties, or of one or more sanitary districts having a population of not less than thirty thousand; or (III) in Ireland, a medical superintendent officer of health of a district or districts having a population of not less than thirty thousand.

The subjects of examination are perhaps also of interest. They are divided into two parts:

PART I.

- a. Chemistry as applied to Public Health.
- b. Microscopy as applied to Public Health.
- c. Physics as applied to Public Health.
- d. Engineering as applied to Public Health.
- e. Practical Pathology and Bacteriology.

PART II.

- a. Etiology of Disease.
- b. Sanitary Law and Administration.
- c. Vital Statistics.
- d. Sanitary Reporting.
- e. Practical Examination in Infectious Diseases.

These requirements necessitate a good training, and for anyone who has satisfied them a career of a high degree of usefulness is open in the higher positions of the public health service. Furthermore, the significant statement is made that "The courses in the various subjects are also adapted and recognized for the examinations in public health of other licensing bodies." So that again, we see the compelling force of general requirement subjecting the person engaging in public health work to the control of licensing bodies, and thus supporting the establishment of departments like those of which mention has just been made.

This condition of things is more or less active all over the Continent, but not so in America — especially in the United States. Canada is fortunate in having the traditions of British law and ancestors to guide her arm, and thus McGill and Toronto universities may receive support for their efforts to establish and carry on the courses training for public health work. How far the University of Pennsylvania will be successful in the same direction it will be interesting to see. Beginning with this Fall — as most of us are aware — the University has established a course in public health, which will include instruction under the following headings:

Sanitary Engineering.

Sanitary Legislation.

Inspection of Meat, Milk and other Animal Products.

The Sanitary Engineering of Buildings.

Social and Vital Statistics in the United States.

Practical Methods used in Sanitary Work.

General Hygiene.

Personal Hygiene.

This course is established because "The authorities of the University of Pennsylvania realize the efforts which are being made in communities throughout the country to obtain officials who have had some special training in matters pertaining to public health." They say further that "Each year the demands for men of this type (either as chiefs of departments, or in some subordinate position) is increased, and at the present time there is a lack of men to fill such positions."

So far as I am aware, this is the first course systematically arranged in the United States for the needs of persons wishing to enter upon public health work, and, as I have already said, the result will be watched with much interest by all friends of the movement. Thus far, comparatively little encouragement has been secured to those, who, like myself, have endeavored to have some definite action taken by teaching bodies. Besides the inertia of natural conservatism that is always to be encountered in laying out new lines of effort, another, and as it seems to me, a more vital obstacle has been found. This consists in the fact that there is no standard of attainment set by the health authorities, to which their employes must advance, nor is there any central licensing body by which such standard could be upheld. One of your own committees recognized this condition of affairs several years ago, and in their report use the following words:

"REGULATION OF HYGIENE BY BOARDS OF REGENTS.

"Your committee would strongly urge that the health boards as far as possible insist upon only such men receiving the title of sanitary inspector as have earned it by passing the examination, to give the necessary encouragement to induce people to obtain these qualifications and by classing those who have not taken them as unskilled, making a distinction in their official titles.

"Your committee would also suggest that such portions of this report as may be adopted by the Association should be submitted to those interested for their criticism and the effort made to secure their co-

operation; and, if a distinction is made between the minimum amount to be made compulsory everywhere and the normal standard which might be optional in some cases, we think that the matter can be practically tested without very serious delay."

So far as I can discover, this committee made no suggestion as to the constitution of the "Boards of Regents" mentioned, nor has any systematic action ever been taken upon their report. Nor is it easy to see how any action can be taken that shall be legally compulsory upon the health boards of the country—even the long-desired National Board of Health could hardly assume such power—although, if it were in existence and chose to conduct examinations, leading to certificates of sanitation and diplomas of public health, its influence would be very strong for good in this direction. In default of such central authority, however, it is conceivable that the existing State Boards of Health might have their powers so increased that they could conduct such examinations. If this were done, it seems certain that those who attained the required standard would more easily secure positions than others without such evidence of proper training for the work they desire to do. Any such plan would need hearty co-operation throughout the country—that the standard set in each state should have an approximately equivalent value. It could unquestionably be carried out if sufficient interest could be aroused.

In default of such action by the State Boards of Health, through lack of interest or of power, the Association itself might take similar action. Through a carefully selected board of regents or examiners, it could offer such examinations as seemed best to any candidates desiring to take them. To such candidates it could offer certificates that would be a guarantee that the individual had secured proper training for public health work. If the members of the Association, as individuals, supported the Association as a whole, by selecting the holders of these certificates for positions in their control, the value of the examinations would soon be raised to its proper level.

Only by some such action is it possible to foresee any speedy and general movement on the part of the teaching bodies of the country to provide the systematic instruction in public health work, for which we believe there is so much need.

TEACHING OF HYGIENE IN ELEMENTARY SCHOOLS.

BY DR. MIGUEL MARQUEZ, CHIHUAHUA, MEXICO.

1. If the school, as an eminent philosopher has said, purports to impart, in a relatively short time, and in general to persons of ordinary intelligence, what the most vigorous intellects have discovered in the course of centuries, in relation with the order of the universe, it is undeniable that the first condition which the pupils require to attain the best success in education is "*mens sana in corpore sano*," that is to say, good health.

2. For the preservation of health and the improvement of humanity, under the three-fold standpoint, physical, intellectual and moral, the diffusion of a knowledge of hygiene is indispensable, either this being transmitted through the press, by popular lectures, or, best of all, at the schools, where it should have the place of preference, so that from the "kindergarten" to the high schools the young people may get used to practice the rules of hygiene, thus becoming a habit among them, instead of being limited to a simple theoretical knowledge.

3. Hygiene may be considered, in primary or popular schools, under two different ways: as an exposition of the principles which must be followed in the selection of the ground for the school building, its orientation, conditions, ventilation, light and heat, classes of books, furniture, distribution of time, programmes, exercises, etc., and as a manner of teaching, for which organization we must always keep in mind, that this branch of education performs a very important part, as a high educational and instructive resource, as do all other subjects pertaining to a scientific plan of education.

4. Therefore, hygiene should be taught in every one of our schools, from the elementary or popular to the superior ones in a series of studies beginning in the first two years of the primary schools, in the form of intuitive lessons, and ending with the superior or higher courses, preceded by a brief study of anatomy and physiology, as hygiene is nothing more than the laws which govern the best development of the human body.

5. In order to avoid the danger that these studies might be only theoretical and without practical results; that the children would not learn by rote as in the times of old, forgetting in a short time the most simple facts, it is necessary that the teacher should feel the great impor-

tance of hygiene, in such a manner that he, by all means, makes his pupils to gradually assimilate its notions as expressed. The teacher must not lose whatever opportunities to infuse into the minds of his pupils the rules of hygiene, not only by precept but as well by example; the professor must illustrate his lessons by observing good habits and customs of hygiene in his person, as well as on the building, surroundings, furniture, etc., at the school, thus offering models to the children of the most effective character, showing the contrast of these conditions with their home surroundings. Thus the school will become, as a celebrated French educator has stated, a palace, a place of inspiration, which, on account of its beautiful surroundings, its perfect cleanliness and its conveniences for living, will inspire respect in the pupil and may awaken in him the desire of creating, some day, similar conditions at his own home. In this manner the school contributes to his physical comfort and, let us not forget it, also to his moral development.

6. To achieve such a satisfactory result, as can be derived from the good system of modern education, it is indispensable to adopt convenient methods which will correspond with the age of the children; therefore, intuitive teaching during the first two years of education will be the powerful lever which, at the same time awakens and develops the intelligence of the pupils, causing them to acquire the habit of observation, constant attention and an increasing desire to compare, investigate, etc.

7. The foundation of this is not only the fact established by Pestalozzi that *"intuition is the source of our knowledge,"* but also that its proceedings are those which better adapts to the conditions of the psychological evolution of the children. These methods require from the child not only to see, but at the same time to examine, starting from sensible perception, to observe, analyze, compare, distinguish and find differences and similarities; thus the spirit of investigation and invention is excited, stimulated and the intellectual faculties of the children are put into action. The intuitive method, used in such a manner, not only causes the child to see, but it teaches him to perceive and in a way that is both agreeable and profitable leads him to the exercise of his mental activities. Hence we arrive to the conclusion that intuition is an excellent and most effective auxiliary for the education of the mind, giving to the instruction the means to realize this culture and the indispensable condition to be adjusted according to the progress and peculiar circumstances of intellectual evolution, contributing to the development and discipline of the mental faculties, constituting therefore a true intellectual gymnasium.

8. The above-mentioned conditions were taken into consideration in the State of Chihuahua, Mexico, when, among the recent reforms to the Law of Public Instruction, the study of hygiene was adopted in accordance with the detailed programmes which we will have the honor to present to the consideration of this distinguished Association on its future or next meeting.

9. For the present, we will give a simple outline about the lessons on intuitive teaching and physical and natural sciences, which may form the basis for the study of this subject in the primary schools:

FIRST GRADE.

Intuitive lessons on water, domestic animals and common plants, as hereinafter set forth, to be followed, respectively, with hygienic subjects, which may be developed in connection with such lessons:

I. Water; potable water for drinking purposes, preparation of food, for personal cleanliness, washing of clothes; pathogenic germs which it contains and diseases which, through the water, might be transmitted and easy and practical means to sterilize it.

II. The cow: meat, milk, butter, cheese, etc.

III. The pig: its meat, lard, etc.

IV. The chicken: meat, eggs.

V. Wheat: flour, bread.

VI. Potatoes.

Intuitive study in regard to the hygienic conditions which these nourishing substances should have, and the indications under the standpoint to be considered for the development, repair and preservation, of the human organism.

SECOND GRADE.

In this grade, special attention should be given to dresses and cleanliness, together with the intuitive lessons, as follows:

I. Sheep: wool, dresses.

II. The ox: hide, shoes.

III. The cotton plant: cotton goods.

IV. Flax: linen clothing.

V. The mulberry tree: the silk-worm, silk.

Intuitive studies in regard to the general rules for dressing, and indications about woolen, silk, cotton and linen clothing, according to the different seasons and climate, etc.

THIRD GRADE.

The programme of the third grade shall contain elementary notions about the air, water and combustion, being also convenient to give hygienic lessons regarding rooms, ventilation, light, heat, etc.

FOURTH GRADE.

Upon reaching this grade, the pupils will finish an elementary course of anatomy and physiology, as well as the physical and natural sciences. The teaching of physiological functions should be taken as a basis to acquaint the children with the rules of hygiene, besides about infections in general.

Thus a complete, although a rudimentary course of practical hygiene will be developed in the primary instruction.

FIFTH AND SIXTH GRADES.

In these grades the course of study ought to be extended, establishing the scientific principles of the lessons taught, causing the pupils to apply the physical, chemical and biological laws, studied in the primary grade, to the investigation and explanation of hygienic laws; thus completing a theoretical and practical rudimentary course of hygiene.

METHODS FOR SECURING GREATER UNIFORMITY IN THE INSTRUCTION AND CO-OPERATION TOWARD PUBLIC HEALTH "BY MEANS OF THE TEACHING OF HYGIENE TO THE CHILDREN IN SCHOOL."

BY DR. EMILIO J. BONILLA, PUEBLA, MEXICO.

Hygiene teaches what man should do in order to preserve health when in normal conditions; and it also teaches how to apply its precepts to regain health when the organism is infirm, in which latter case hygiene is an efficient co-worker with medicine.

The human being is endowed with powers that manifest themselves with life, develop with age, and after reaching their climax gradually decline with the decline of corporal vigor and disappear with death.

This evolution takes place naturally and spontaneously, without any direction or assistance; and still, the organism acquires the necessary strength and endurance to successfully struggle against external conditions and emergencies of life.

If this development be wisely directed from the very first years; if it be not abandoned to the spontaneous efforts of nature alone, but artificially and deliberately carried on by the assistance of the teacher, the result will be a complete development, both physical and mental.

Such a preparation cannot take place in a short time nor at any period of life; consequently, the epoch of life beginning at birth and extending to the fourteenth or fifteenth year, — a time during which the individual is not in need of employing his time in the various callings of life to attend to the most imperious necessities — is the most convenient to take advantage for increasing the human powers. Furthermore, this period of life gives the opportunity of proceeding with the necessary amplexness of time in feeding the brain, developing strength and shaping the feelings; and at the same time the powers being in a tender state and the character without strongly manifested tendencies, man is in an attitude of receiving to advantage the beneficial influence of the teacher.

It is to this need of the child and youth that the primary and kindergarten education respond. Oh, that it might be begun even from birth! It would secure more ample foundations to a preparatory edu-

cation and opportunity later for the individual to reach physical, intellectual and moral perfection.

In order to succeed in this threefold preparation, it is indispensable that the teacher possess a thorough knowledge of the physical and psychical being of the pupil in order to be able to induce the ensemble of precepts, principles and laws that must apply in exercising his noble mission.

The child possesses a natural tendency to accept anything that concurs to his perfecting; this circumstance and the docility with which he submits to the will of his teacher, should be taken advantage of in the cultivation of his powers, with the end in view, of placing him in the proper condition to enter the social organism, already shaped, and with a maximum of physical and mental strength.

But the action of the teacher is not limited to his knowledge and growth of the energies of the child; he is to realize at the same time that the child should gradually acquire a certain amount of knowledge of facts that may be means of being useful to himself and to the others.

The importance of the teacher's work once acknowledged, the necessity commends itself of a most ample preparation for the educator, and it is to such necessity that the normal schools contribute the answer.

The government of the State of Puebla fully appreciated this, and struggling to conquer great difficulties, founded the first normal schools in the Mexican Republic, the inauguration having taken place on September 16th, 1879, for the school for young ladies, and January 24th, 1880, for the school for young men. Since then the curriculum, rules and laws have been changed in accordance with the educational progress of the world.

At present the curriculum is scheduled in four *professional* years, at the end of which time each candidate must certify having practiced at least six months in the annexed primary practice school.

The curriculum is as follows:

First Year.—Pedagogical Anthropology (1st year), including the elements of Physiology and Anatomy.—Language (1st year), including Etymology, Orthography, language exercises in declamation, reproduction, imitation and composition.—Higher reading.—Mathematics (1st year).—Arithmetic and Geometry (plane).—Geography (1st year).—Ethics.—English (1st year).—Bookkeeping.—Penmanship.—Drawing.—Gymnastics and Military Drill.—Music (vocal and instrumental).

Second Year.—Pedagogical Anthropology (2nd year) including

Psychology. — Language (2nd year): Syntax, Prosody and exercises in declamation, reproduction and composition. — Higher Reading. — Mathematics (2nd year): Algebra and Solid Geometry. — Elementary Physics. — Elementary Chemistry. — Geography (2nd year). — History (1st year). — Ethics. — English (2nd year). — Drawing. — Music. — Gymnastics and Military Drill.

Third Year. — Pedagogy (1st year): General and Detailed Methodology. — Language (3d year). — Algebra and Geometry. — Elementary Geology and Mineralogy. — Elementary Zoology and Botany. — Geography (3d year). — History (2nd year). — Logic. — Civics. — Common Law and Elements in Political Economy. — French (1st year). — Drawing. — Music. — Gymnastics and Military Drill.

Fourth Year. — Pedagogy (2nd year): Organization and government of the school. History of Pedagogy. — Language (4th year): Literature, General Grammar and exercises in declamation. — Physical Sciences as applied to industry. — School Hygiene. — Geography (4th year). — Civics, Law and Political Economy. — French (2nd year). — Music. — Gymnastics and Military Drill. — Practice in the Primary School.

With but slight modification this same curriculum is used both for the male and female students.

The description of this program shows very clearly that our normal schools endeavor to equip the teacher with a variety of subjects that may put him in an attitude to undertake under the best auspices the difficult labor of education.

Each of the signatures in the curriculum are of great use to him, each is necessary, as he shall have, more or less, to make a practical application of the knowledge each of them has furnished him.

It was not overlooked in legislating for these normal schools to prescribe a greater amount of time to those subjects which are considered by their extension and importance as more essential. There are detailed programs marking carefully the themes that should be given under each subject.

Let us see, then, what it is that the teacher acquires in our schools in regard to hygiene, in order to fulfill the precept of that the teacher should have a perfect knowledge of the subject that he may impart instruction.

In the first year in anthropology are taught in detail the functions of all the different organs of the body, and it is the duty of the professor to give the hygienic rules regarding each function.

In the third the modern methods for teaching hygiene are given.

In the fourth year school hygiene is taught on a broad plan, as follows:

SCHOOL HYGIENE.

The object and importance of hygiene in the school.

The general conditions for a school building:

I. — Location, condition of the soil.

II. — Orientation, according to the climate.

III. — Building. Hygienic conditions of the building material.

IV. — Outdoor dependencies, such as yards, water depots, gardens, staircases, etc.

V. — Indoor dependencies: Janitor's room, parlor, inner court, washing room, dressing room, gymnasium.

VI. — Water closets and urinals. Influence of these on the general health of the school. The absolute need of a perfect hygiene in its installation. The various systems of water closets. Disinfecting substances.

School rooms: Form, dimensions, cubic capacity, number of pupils each should contain, walls, roofs, floorings, doors and windows.

Ventilation: Chemical modifications in the air in the school room from the breathing of the pupils. The necessity of a good system of ventilation.

Light. Its influence on the human system. Harmful effects of a bad system of light distribution, by excess or by defect; what the conditions are for a good system. Artificial light. The conditions for hygienic lighting of libraries, rooms for drawing classes, adult schools, etc.

Heating. How to obtain a normal temperature in the class room by heating. Various heating apparatus, their advantages and drawbacks from the hygienic and economic standpoints.

Refrigeration.

School furniture. A criticism of the old style furniture; its direct and indirect influence upon health. The normal position of the pupils. Hygienic conditions for good school furniture. An examination of the various school furniture models.

Hygienic conditions for teaching objects: books, paper, pens, penholders, ink, slates, slate pencils, blackboards, maps, atlas, spheres.

Conditions for admission of children into the schools. Hygienic distribution of the school work according to the age of the pupils. Hygienic rules to which the time schedule should be subject. How many hours the children should be kept in the school.

Physical education. Its need in order to balance the effects of exercise or excessive mental work.

Exercises recommended for the physical development. Gymnastics. A comparative study of the various gymnastics, gymnastic games and free sports. Field excursions, picnics, military drills, manual work, horticultural exercises.

Song. Advantages in developing the voice. Physical and normal influence of singing. Precautions in the school to avoid the transmission of contagious diseases.

Classification of the contagious diseases that are apt to be transmitted in the school. Elementary knowledge about the most important characteristics of such diseases.

Vaccination and revaccination. Medical certificates and the mark to find out whether a child has been vaccinated.

Practice in vaccination.

School diseases.

Immediate assistance in case of accidents and emergencies.

About establishing in all schools a medico-hygienic supervising service, and a good collection of essential medical substances.

Especial dependencies and furniture for the kindergarten.

Especial hygienic prescriptions for boarding schools. Dormitories, their arrangement and furniture, dining room, kitchen, tub and shower baths. Natatorium. Laundry. The punishments from the hygienic point of view. Hospital room and its dependencies. The principal's residence.

Conditions for admission of pupils to boarding schools. Food. Physical exercise. Medical service. Moral hygiene. Discipline and vigilance. Mail, etc.

From all said above may be inferred the importance accorded to hygiene in education, and how it is endeavored to thoroughly prepare the teachers to obtain the greatest results in the school, and moreover to popularize the knowledge of the matter.

Let us study how this subject should be taught:

From two standpoints may we consider hygiene: as forming a collection of principles derived from their sciences (theoretical part) or as the varied applications we can give to those principles (practical part).

The knowledge of the human body in health or in sickness, of the external medium and its influence upon it, gives us the key to the general laws from which to draw particular rules and practical means to apply in various cases.

In giving practical application to those principles a number of objects and auxiliary apparatus are necessary to efficiently help the educator; each one of these elements is to assist the child in the application of his faculties and in impressing profoundly on his mind the fundamental or theoretical part by observation of the practical part.

The powers should be put in action according as they gradually acquire vigor; not all powers acquire it at the same stage of life.

At first it is necessary to utilize the sensorium and present natural things and facts that are realized in the practice of hygiene in order to give intuitive notions. Of course, in many cases it is impossible to show every object that is talked of in a lesson, and then it is necessary to recur to representations or imitations by using diagrams, tabulation, or at least descriptions, though this way does not give the best result we aim for, as no symbolic system can ever give such accurate notions as the real object.

This way of teaching should be given between the ages of about six and nine; from the tenth year higher mental faculties may enter into action, such as conscience and intelligence.

At this age the child's higher powers being able to work he may begin to understand the relation existing between the intuitive notions he has acquired through his senses and the laws and principles to which such notions are subject in their application.

Should the subject of study be simple, the intuitive method must be used; if the subject is complex, the method to be followed ought to be analytic or synthetic or a combination of both; but by all means never forgetting the order in which the powers of the child appear, in order to elect the most appropriate method to succeed.

The teacher should also verify whether the notions acquired by the pupils are correct, and he must examine the mental work of the pupil to find out whether he follows the right method in each case.

Following the above directions the teacher should proceed according to the following program:

I. *Air and Dwellings.* — Causes and effects of the alteration of the air. Disinfecting substances. — Light. — Heat and cold. — Dampness of the air. — Dwellings. — General conditions, ventilation, heating and lighting.

II. *Food.* — Conditions for good food. — Water. — Filters.

III. *Care of the Body and Work.* — Cleanliness, complete and partial baths. — Beds. — Clothing. — Exercises. — Work. — Intellectual work. — Rest. — Accidents; first resources in case of hemorrhage, wounds, luxations, burns, poisonous bites. — Immediate assistance to

the drowned or choked by strangling or by gases. — Precautions to avoid the contagion of skin diseases, epidemics and ophthalmia.

IV. *Temperance.*

To what powers of man are these teachings directed?

1. To the physical powers, mainly, as they tend toward the keeping in good health the body of the children who constitute the school population.

2. To the intellectual powers, inasmuch as they concur together with other matters of teaching to the symmetrical development, so that the children may through external come to internal perceptions, form the habit of judging, analyzing and inferring by themselves, and come in the end to awaken their creative powers that aspire to the betterment of the conditions of life for the purpose of preserving good health.

3. To the moral powers, because the influence exercised on the children by cleanliness in their own person, the neatness, good arrangement and taste in the school furniture, etc., is so profound, not only in what refers to the development of the body, but also as a means of the general culture that reaches up to the highest faculties of the soul.

Allow me to study now, what is the end we tend to by means of the teaching of hygiene in the school.

1st. — The satisfaction of a natural need in the organism of the child in order to favor his life and realize his complete development, so that all his powers may evolutionize freely.

2nd. — Trying to make him comprehend gradually the advantages that the application of the principles of hygiene in the different acts of life will bring him for his perfection.

3d. — To gain the attention of the child in acquiring notions that he may fix in his mind to apply them in order to keep himself in good health.

4th. — To establish the equilibrium among the various faculties, by intervals of rest and activity, in order that education may be symmetrical, avoiding the fatigue caused by overwork of a group of powers.

5th. — To prepare the child through a good physical and psychical development for life, when he is independent of the teacher, and

6th. — To form in him hygienic habits by means of a constant practice in the school and out of it.

To sum up: in order that the public primary school may contribute in direct manner to public health we need:

I. — Competent teachers.

II. — Adaptation of methods to the different circumstances of school life; and

III. — The formation of hygienic habits in the children.

The constant endeavor of the government in the State of Puebla is to bring to practice this ideal in education. It is to this end that it has enacted the Law on Primary Instruction, making it compulsory, law, and uniform throughout the whole State; and in time prominent, so that the teacher is under the duty of giving two lessons daily on the subject. If to these facts we add that the State has 1,280 schools, in which 66,000 are receiving education under 1,700 teachers, we may logically be allowed to deduct that it is worthy taking in consideration what that State contributes to secure more uniformity in the instruction and co-operation of public health through the teaching of hygiene in its schools.

PHYSICAL EXERCISES IN THE SCHOOLS.

By DR. ADOLFO OLIVA, GUADALAJARA, MEXICO.

The necessity of physical exercises has never met enemies. At all times bodily exercises have been considered indispensable for the good functioning and normal development of our organism. The ancients, and more particularly the Greeks, established gymnasiums, public games of strength and skill annexed to their academies, being convinced that a well developed mind can only be found in a sound body. "*Mens sana in corpore sano.*" One of their greatest men, Plato, used to say: "Our soul and body suffer a change by repose and inaction." It is not possible to educate the mind without educating the body.

From Greece, gymnastics passed to Europe; afterwards to Egypt and Persia. Among the Romans, the Field of Mars, the military exercises, the marches, the compulsory public works, etc., replaced the gymnasiums of Greece. Owing to this education the Roman soldier could march long distances carrying with him his arms, provisions for fifteen days, his baggage and camp equipment.

Later on, the corruption of the customs caused the principle, "everything for the education of the youth" consecrated by the former generations to be forgotten, and the Greeks and the Romans finally abandoned that excellent method of developing the organism.

Then follows a long epoch during which physical education was almost forgotten. It seems as if in the triumph of the ideas of civil equality and human brotherhood the contempt for brute force had led to the indifference of the bodily exercises, and it must be noticed that the epochs of physical inaction have also been epochs of intellectual decline.

Rabelais and Montaigne protested against this contempt of physical exercises, teaching the educators that "games and exercises are an important part of study, and that it is neither a soul nor a body that is being educated, but a man." The most distinguished philosophers of the eighteenth century, Condillac, Locke, Diderot, Rousau, etc., proclaimed the same ideas and proposed systems of education in which the hygiene of the body is carefully attended to.

However, not until the year 1863 were direct and effectual measures put into practice to introduce in the public schools physical education, thus acquiring the health and vigor of the organism.

It can be said that modern gymnastics was born with the gymnasiums of Switzerland, Denmark and Germany, by the wise efforts of Pestalozzi, Nachtigall and Gustmuths Lateron. The teaching of gymnastics and of military exercises has been spread through all countries, under the influence of the principles sanctioned by hygiene and pedagogy.

Favoring the spread of physical education the public authorities have obeyed an unselfish and eminently patriotic sentiment. In truth, all children who frequent the schools are called to serve their country as soldiers; it is therefore a patriotic end that is pursued in giving the pupils manly customs and making them acquainted from their childhood with the duties which they have to fulfill in after years.

The bodily vigor of the children is strengthened by physical exercises and at the same time their minds are symmetrically developed and the subjects of study will be easily assimilated.

It is perfectly demonstrated that too much intellectual work, too much attention directed for a long time to a single subject and prolonged inactivity, fatigue and produce general lassitude.

This is the reason why Laprade has denounced as murderous, certain programs of studies in which the distribution of subjects and division of time are not well adapted to the age of the pupils, and in which too short time is assigned to bodily exercises.

Hygiene makes the use of medicines unnecessary for children, avoids the blunting of sensibilities and the perversion of imagination. The child needs sufficient air, physical exercise, sleep and food. He is always happy when engaged in manual labor. This is why the educator drawing his data from nature, must endeavor to modify those school programs which assign the principal work to the brain and mind of the pupil. This high pressure instruction, as Dr. Barthés justly calls it, exposes the child to intellectual weakness and increases his disposition to neurosis.

Statistics prove that many intelligent pupils, destined by their parents to the highest social offices, die, some of them from brain fevers, others from meningitis and all as the result of excessive intellectual work and almost total lack of physical exercise.

Javal, whose knowledge of hygiene is very well known, says: "If you desire to obtain the maximum of useful work, you must distribute the subject of study in such a manner that one considered as a diversion, follows another that requires much intellectual activity; you must, above all, divide the periods of rest, which will be numerous, so that the cerebral fatigue never reaches the point where the attention begins to weaken." Finally, Mr. Duclaux observes that, under the influence

of school plays the character of the pupils suffers such favorable changes that pupils who were inattentive, lazy and insubordinate, have become as correct, attentive and studious as their most commendable school-mates.

As is well known, it is not reasonable, from a hygienic standpoint, to apply to the school all the known systems of physical exercises.

It is, therefore, very important to determine what kind of exercises the children ought to have and what course ought to be followed to secure the symmetrical development of all the tissues and organs of the human body.

There are two methods that claim the first place — that of the easy games and exercises practiced in the open air, and that of Amoros, also called "Method of Difficult Exercises," with its regulated motions and its apparatus.

Most pedagogues and hygienists agree in giving the preference to the first named.

It is a great mistake to think that physical exercises can only be practiced with more or less apparatus and that more or less complicated.

On the contrary, it is necessary to abandon it, at least, for the little boys, who would perhaps give up forever gymnastics, on account of the insurmountable difficulties presented to them in the management of special apparatus. Gallar, who declares himself as opposed to difficult physical exercises writes: "I tolerate them in the same manner and with the same repugnance that I tolerate the nursing-bottle for babies deprived from their mother's breast." Dally advises not to apply athletic exercises to children, who are *better satisfied with the free exercises like races, games, etc.*

It is unreasonable to demand from the child more than he can do, it is for this reason that all exercises that require great effort or which expose him to any accident ought not to be employed.

Gymnastic apparatus is useful, although not indispensable, for grown men, but it is entirely unfit for children. The use of iron rings, horizontal bars, trapeze, cause the abnormal development of the trunk to the detriment of the lower part of the body.

As all these exercises require great effort accidents of all kinds, such as bruises, fractures, wounds, luxations, etc., are frequent.

In great efforts congestion of the brain is noticeable and rupture of the cerebral veins and laceration of the cardiac and pulmonary tissues. Finally, the production of inguinal, umbilical and crural hernia can be explained, remembering that in the act of the effort, the abdominal viscera are suddenly compressed by the contraction of the muscles.

There is another argument against the practice of difficult exercises with apparatus. It requires a certain degree of attention and the brain does not rest.

In my opinion, easy exercises are the only ones appropriate to primary, intermediate and high schools executed as a rule, without the aid of apparatus. I say as a rule, because in this group some exercises are included which require the use of apparatus, but these are not complicated, they are of easy management and do not expose the child to the accidents aforementioned. They are excellent because they divert the child without tiring him, correct the injuries, which result from inconvenient positions of the body, harmonize the movements and development of the muscles of the organism in a methodic and progressive manner. Besides, they are accomplished without any effort of the attention, almost automatically, since the intelligence does not take active part and they are consequently preferable because of the rest they give to the brain.

The physical exercises included in this group are the following:

Preparatory movements; movements of the head, of the trunk, of the upper limbs, of the lower limbs, of the upper and lower limbs, etc.

Military exercises: normal situation of the body, marking the time, changing the step, slow step, quick step, flank marches, change of direction, turning to the right or to the left, etc.

March: slow march, quick march. Race, jump, phonation and singing, swimming, skating, exercises with cane, dumb bells, ropes etc., riding.

The object of the preparatory movements which we find combined in all the variations of physical exercise is the graduated and uniform muscular development of the different parts of the body, such as in the neck, the trunk and the members. As a matter of fact, we know that at the moment of contraction the muscle increases in diameter and diminishes in length, and that the interstitial circulation is suspended; but from the moment the contraction ceases the blood is again precipitated into the vessels. The frequent repetition of the contraction produces a species of massage which favors the vital functions of the muscular tissues as eventually a larger quantity of blood reaches them with new substances for assimilation; the elasticity, vigor, and number of the contractible fibres is also increased. The blood which leaves the muscle that is working, contains a larger proportion of unassimilated material such as carbonic gas, lactic acid, urea, uric acid, leucomaine, etc., etc., and the thermometer shows that the temperature is superior to that of the muscle in repose, the average of which is 05° . These

observations of experimental physiology, clearly show that the muscle in the state of contraction breathes with greater activity.

In those cases in which the muscle is contracted for a long time without being allowed any period of repose the refuse substances accumulate in the blood in notable quantities, and by this means expose the individual to the death of his muscular elements through the coagulation of the myosin and to grave symptoms of auto-intoxication.

From this we can deduce the unavoidable necessity of dividing the periods of muscular activity by others of repose in order that the noxious substances may be properly eliminated, that the contractible fibres may return to their normal chemical reaction and that their contraction may be painless as at the commencement of the work.

The increase in the diameter of the muscle, under the beneficent influence of systematic exercise has been demonstrated by the observation of pedagogues and hygienists. In fact, in the schools in which the physical exercises are best attended, an average increase has been noted of 1.20 centimetres in the diameter of the arm, the forearm, the thigh, and the calf in those pupils who have gone through a course of gymnastics for a period of five months.

These effects of movement, which we may call local, react on the great vital functions. All work that is imposed on the locomotor apparatus is evidenced by an acceleration in the circulatory, digestive and respiratory functions; in the changes of nutrition of the secretion, and excretions as well as in the functions of the skin; in one word, the effects reveal themselves through a more active life as the result of the physical education of the children.

As regards the military exercises and drills, I can only say, that besides the advantages which they bring about in the normal development of the system, they prepare the child who is the citizen of the future to fulfil the duties that later on may be imposed on him by his country. The school programmes contain the rules that are to govern the different movements in marching, changing front, etc., all carefully selected from the rules of military practice, and are intended to give exactness to the movement and to inspire the pupil with a spirit of discipline.

The march constitutes the standard of automatic movement. It brings into activity the most powerful muscular masses of the system; promotes the circulation and respiration and is admirably adapted to the development of delicate children, always provided that great care is taken not to exceed the limits of their powers and cause fatigue.

During a march the body rests alternately on one of the two feet without at any time abandoning the floor; the entire muscular system

enters into activity, not only that which belongs to the members which are brought into action. In marching the child advances his leg at each step without any bending of the knee joint, from the first he places his heel on the ground, afterwards the sole of his foot, and finally the toe. In all of these movements the body being carried forward according to whether the road is on level or sloping ground, the trunk is raised and the upper members are moved in a contrary direction to the lower.

The march includes from the slow walk (60 to 65 steps per minute) to the quick-step (85 to 95 or more steps per minute) which is denominated "pedestrianism." Of these two styles of march I give the preference with Barthés, Laffon, Labit, Kuborn and other distinguished hygienists, to the quick step on account of the activity which it imposes on the pelvis, the vertebral column, the chest, the members and the viscera contained in the natural cavities.

The senses of hearing, sight, touch, and the muscular senses are also required in this kind of exercise. The sonorous and luminous impressions, the level aspect, the slopes and accidents of the ground, the state of the atmosphere, etc., are all circumstances that bring the brain into connection with nature without any appreciable fatigue.

The exercise of marching is so complete and its results are in practice so satisfactory, that it should be one of the principal points of the school programmes. But in order to render this exercise really hygienic it must be practiced in the open air, if possible in the country, and not in the center of populous cities, where the space is generally reduced and the atmosphere vitiated.

On the other hand, in this form of marching we pursue another object which is no less interesting: the instruction of children in certain branches of learning, such as botany, zoology, mineralogy, etc., of which the children can obtain a knowledge in their walks.

It is necessary to remember that ossification is not complete until the age of 25, and that the great vascularity of the osseous extremities predispose children to that terrible disease that in pathology is denominated "osteitis." Founded on these anatomo-pathological data, and after long experimental study, the following distances have been fixed on as the maximum that a child can without injury walk within a specified time:

At the age of 12 years, 6 kilometres in 3 hours.

Between 12 and 15 years, 9 kilometres in 3 hours.

Between 15 and 18 years, 12 kilometres in 3 hours.

At the time of starting the boys on an expedition, special care should be taken to arrange them in groups of the same age.

A race is different from the habitual locomotion or march, in that it is more rapid and because at a specific moment the body abandons the ground and is suspended by a species of retraction of the legs. In a race the feet are seen alternately touching the ground, and each time that one of them leaves it the body is projected upwards and forward. The child who runs carries his bust sloping forwards, the upper members doubled against the thorax, the hands closed, and is principally supported on the toes. As he has not time to take a deep breath he makes up for it by an increased number, only breathing with the upper parts of the lungs so that part of the air remains stored in the respiratory organs as in the act of making an effort. We thus understand how it is that during rapid running suffocation promptly supervenes and hematoxis is incomplete.

If this exercise is not carried to excess, and if care is taken to throw the head and bust backward in order to avoid suffocation, running exercise even more than walking increases the circulation and respiration and facilitates the functions of the skin, besides increasing the animal heat and giving the pupils increased dexterity and agility.

It is important to watch that the children run a little every day without making any great efforts, progressively increasing the distances by five or six metres per week. According to my personal observations children may, with this precaution, run in the country and without any appreciable fatigue the following distances: Children of 5 years, 100 metres; children of 8 years, 200 metres; children of 10 years, 300 metres; children of 12 years, 500 metres; children of 15 years, 1 kilometre; those of 17 years, 2 kilometres; and from 18 and upwards, 3 kilometres.

Labit is of opinion that running exercise should not exceed from 105 to 115 steps per minute, and that when it goes over 120 the runner is exposed to the accidents above mentioned.

In order to prevent the children from taking cold when they are perspiring from the effects of the running, it is recommended that they should be dressed in non-conducting cloth, such as flannel and at the same time easy fitting, so that they will in no way interfere with the circulation. Their shoes should also be easy fitting, and have no heels or nails, in order to facilitate the running and avoid the falls that would be dangerous for children.

Jumping is a kind of exercise that is naturally derived from walking and running. Although jumping, whether high or long, is of special service in the development of the lower members; this exercise, nevertheless, brings the whole of the muscular system into activity, increasing the flexibility and elasticity of the joints and gives the sight

certainty and precision. It can be done by the successive doubling and extending of the legs alone, of the legs and thighs, and may be preceded or not by a short run. In any case, jumping requires the movement of all the members of the thorax and abdomen.

It is to be noted that, although this exercise presents some advantages from the point of view of muscular development, its application cannot be recommended in the school on account of the many accidents to which it exposes the boys. In fact, the pupils who jump much in the course of time suffer from pains in the joints, which Rableau has designated under the name of pseudo-rheumatism. Other frequent evils caused by jumping are affections of the brain, loosening of the abdominal viscera, displacements, sprains and fractures, breaking of the Achilles tendon, etc.

The danger is still greater when the jump is made with the assistance of an apparatus, such as the vaulting pole, spring-board, etc.

Phonation and singing exercise an unquestionable influence on the development of the thorax.

The importance of vocal exercise has been understood from ancient times. Celsus advised reading in a loud voice after eating, in order to facilitate the digestion; but I would observe that this advice of the learned writer is supported on a false interpretation of the fact, which was excusable at that period, as although it is true that reading after eating facilitates the mechanical part of the digestion, on the other hand the blood is turned away from other organs and especially from the brain, and in this way constitutes a difficulty in the formation of the digestive ferments in sufficient quantity to carry on the normal chemical digestion. The singing of monks and nuns in part takes the place of the exercise which is forbidden by monastic rules, and the cries of children in their first infancy joined to the limited movements of their members contribute to the development of the new organism. It has also been noted that persons who habitually speak in a high voice present a remarkable immunity to diseases of the respiratory organs.

Statistics show us that twenty-five per cent. of the deaths are caused by affections of these organs, and it is therefore necessary to procure their prophylaxia by means of vocal exercises in the school.

Reading, declamation, singing, admirably serve for the development of the thorax and vocal organs; but it is of importance that the teachers should carefully avoid the premature and exaggerated education of the voice, as it would probably be permanently injured. It is for this reason that the rule of school hygiene provides that vocal exercise, and specially the singing, should be daily but short. It is also necessary to avoid these exercises being carried on whilst the pupils are marching,

as in such case the fine dust which is raised from the floor by the movement of the feet penetrates, together with the current of air, into the vocal organs which for the moment are congested through their functional activity and in that way may cause an irritation and even an acute or chronic inflammation.

During the period of puberty the vocal organ is in a state of greater activity, and therefore has a greater predisposition to inflammatory affections. It is for this reason necessary that, during this state of the young life, the vocal exercises should be directed with greater precaution than under ordinary circumstances.

Swimming is a splendid and useful exercise, as well as a powerful means of inculcating habits of cleanliness on the child. This exercise greatly stimulates the functions of nutrition, through the deep breathing, the sustained contraction of certain muscles, as well as the very varied movements of the trunk and the members which are required in its execution. To this hygienic effect we may add the tonic action of the cold water, the air and sun and the rest which the bath gives to the nervous centers.

As an art, nobody can doubt the utility of swimming for children, who by it are placed in a condition to overcome the dangers that are so frequent in large bodies of water.

Unfortunately, the swimming tanks which form an excellent school of natation have not been generalized in all educational institutions, on account of their heavy expense; but, notwithstanding this difficulty, many cities now have large bathing establishments for the people, which are utilized by the children of the schools.

It is well to preserve the gymnastic lessons with apparatus in the school so long as the use of them is lessened, as it is necessary to remember that in the educational institutions we pursue a hygienic purpose, and not the formation of gymnasts or professional acrobats.

In view of the grounds on which hygiene bases its demand for the withdrawal from the school of the trapezium, parallel bars, rings and other apparatus that require considerable effort and which expose the boys to bad accidents, preference should be given to the exercises with sticks, indian clubs, skipping rope, the Anderson elastic rope, games of ball, see-saw, etc., always provided that they are under direction or supervision and played between boys of the same age. Children with pleasure accept these games, which, on the other hand, contribute to the vigor and agility of the body, its elegant bearing, and at the same time assist the most important functions of life.

Bicycle riding, an exercise that is generally practiced in the open air, is much to be recommended as it brings into activity all the muscles

of the different parts and especially the joints of the leg from the hip downwards. In bicycling the muscles of the back keep the trunk of the body upright, and therefore it is not true that this exercise, as was at first thought, predisposes to deviation of the vertebral column (Briande Champoinniere).

Nevertheless, it is well to avoid excessive velocity, and also to prefer the use of machines with high handles and lower seats than those at present made by the manufacturers. Practiced under these conditions, cycling is an excellent exercise. In any case, it is well to take an expert opinion, as it is known that some affections of the prostata, kidneys, occult affections of the heart and certain organic defects which are unknown to the physician prohibit this sport.

Equitation is very favorable to the good working of the respiratory organs, and on account of the series of contractions which it produces and which are intended to maintain the equilibrium of the body, the upright bearing of the body is secured. Nevertheless, it is well to avoid excess and to forbid it when conditions are not suitable. It also presents the advantage of being very agreeable to children, like military drill and fencing. For this reason riding exercise has been said to interfere with study, but in this as in everything else moderation is indispensable and the learned and prudent professor will know how to distribute the time between pleasure and the school duties.

As can be seen, there are not wanting reasons that support this delightful exercise. It is said to demand heavy expense, but in my opinion we ought to obtain the assistance of the governments in order that, under proper authority, the cavalry officers should teach school-boys the exercise in question.

Generally speaking physical exercises should be carefully watched over, as we must bear in mind that on account of their want of thought and the enthusiasm with which they enter into all games, boys are especially liable to all kinds of accidents. The school physician ought always to be consulted as to the capabilities of the pupils for certain exercises as well as how far they can be practiced. It is also very necessary that the professor should feel medically certain that the boys are not suffering from any diseases that would render the exercises dangerous and especially those that require effort.

During the exercises care should be taken that the boys are dressed in easy-fitting clothes, in order that the circulation may be entirely unimpeded, and in no case should they be allowed to use leather belts, which cannot be stretched and which predispose them to rupture. Broad belts should be preferred, made of elastic cloth, as they do not expose the wearer to that danger.

It is not a matter of indifference as to whether the exercises are undertaken at any particular hour. Hygiene requires that they should be taken an hour before and three hours after eating, in order to avoid disturbance of the digestive functions which might be caused by the violent movements.

Children's games require plenty of pure air and space. It is well known that a person who is taking exercise requires seven times more oxygen than when at rest, a condition that increases the hygienic value of physical education because it favors the respiratory functions. In order to realize these conditions the best plan unquestionably would be to take these pupils into the country; but as this is not always practicable, the legislator has provided that every new school building shall be supplied with its gymnasium or else two dependencies which the pedagogues designate by the names of covered and uncovered yards.

In view of the nature of the physical exercises that are preferred for pupils, such as marching, running, movements by word of command, etc., we can understand that the gymnasium is not entirely indispensable and for this reason preference should be given to the two annexes above given.

The uncovered yard presents the advantage of great space, five metres for each boy and never less than 200 metres whatever may be the number of pupils — an abundance of air and sufficient light.

The rectangular or elliptical forms are those that are most recommended for this annex and both in the floors as well as in the walls entering and salient angles should be avoided as well as every kind of turn or asperity. Cement, asphalt and other impermeable substances which are employed in laying the pavement (that should always have a sufficient slope) will only be put into the sidewalks, and the rest of the space should be covered with small shingle or crushed scoria. It is desirable to plant trees at a certain distance apart, so as not to disturb the games or the supervision of the children, that there should be a free circulation of the air, plenty of light, and that the premises should not retain humidity that could be injurious to health.

I consider the erection of fountains in the uncovered yard unadvisable, as they are a constant source of danger to the health and even to the lives of the pupils for the reason that however great may be the vigilance of the professor the children are liable to fall in and get drowned, even though there may not be much water in them.

In this case, if the boy's head strikes the bottom of the fountain it brings about a disturbance in the brain that prevents his asking for help, so that in a few minutes he is drowned. On the other hand, if the fountain is not cleaned with the necessary frequency, bacteria and

microscopic animals are developed in the water, and may become the cause of infecto-contagious diseases. In my opinion, it is preferable to receive drinking water by means of hydrants, which secure the pupils from all the dangers above indicated.

For the comfort of the children and to give them rest it is desirable to place seats (preferably of wood and iron); but arranged in such a manner as not to disturb the running, walking and other exercises which are practiced in this dependency of the school building.

The covered yard is intended to take the place of the uncovered one on rainy days and whenever it is considered undesirable to expose the boys to the heat of the sun.

The area, floor and walls, should fulfill the same conditions as in the uncovered yard, with the exception that the walls should have a height of four metres.

For the purposes of light and ventilation, this building should be provided with a proper number of doors and windows opening out into the uncovered yard or into the garden.

It is not desirable, as some authors claim, for reasons of economy to place the wardrobe and lavatories in the covered yard. The unhealthy emanations that are thrown off from the clothing and soiled water render it necessary to avoid that multiplicity of services which would expose the pupils to the noxious effects of an atmosphere vitiated by foreign substances. In mild climates, it would be possible to economize the expense required by the construction of this annex by the building of a shed in which the boys would take their physical exercises in bad weather.

Physical education should not be confined to boys' schools. The girls will also find in those physical exercises which are adapted to their essentially delicate and sensitive sex a powerful assistant in their struggle against their exaggerated neuropathy and against the frequent attacks of chloroanemia.

Easy exercises are especially desirable for girls, for the reason that they correct their defects in bearing and impress on their movements that grace and elegance that assures the prestige of their sex. The physical education of girls also favors the development of the genitive organs and as far as possible increases the vigor of their general constitutions. It is important not to forget that the girl of to-day is the mother of the future, and that the children may inherit, either directly or by atavism, the good or evil qualities of the maternal organism.

Fortunately for the nations, the intellectual and physical culture of the fair sex has acquired such a healthy extension in our schools that

the words of Goodal, "All the ability of a woman consists in hiding the absence of organs so necessary to beauty and maternity and the pale virgin of to-day will be the sickly and barren woman of to-morrow," cannot be justly applied to the girls of the present generation.

In closing this paper I cannot do less than remind my hearers of the fact that the future of nations is intimately connected with the importance of the above observations on school hygiene.

INFLUENCE OF DIFFERENT KINDS OF HANDWRITING ON THE HYGIENIC POSTURE AND DEFORMITIES OF SCHOOL CHILDREN.

By DR. M. URIBE y TRONCOSO, Mexico, D. F.

Lately there has arisen in Mexico the old discussion as to the kind of handwriting which should be adopted in schools from a hygienic point of view, and the partisans both of sloping and upright letters have adduced esthetical, ophthalmological and pedagogical reasons in defense of each.

In the United States a movement has been begun, in the same direction, by the partisans of vertical letters against sloping ones,¹ the use of which is almost general in the different States of the Union.

The object of the present essay is to analyze, from the hygienic and ophthalmic point of view, the different requisites needed for handwriting so that its execution shall not cause thoracic deformities nor eye troubles, and so render the school injurious to the child's health.

When, more than twenty years ago, attention began to be drawn to deformities of the vertebral column brought on in school, and when statistics further proved that nearly 27 per cent. of the scholars in primary schools in Europe have a lateral curve of the spine resulting from bad postures on the school bench, especially when writing, the blame was laid on sloping penmanship for the inclination to place themselves crosswise or diagonally before the desk, which causes an advance of the right elbow, a lowering of the left, which comes off the desk, while the feet go to the left, leaving the right side in contact with the desk.

Statistics regarding myopia also proved that the too near approach of the eyes to the paper, produced by faulty postures, is one of the principal causes of the constant increase in the number and degree of cases of near-sightedness observed in schools. Even the fault of proper light was certainly considered as a very important factor, but of secondary value. So, in 1882, the School Hygiene Commission of France did not hesitate to fasten the responsibility for these bad postures and the increase of myopia, on slanting or English handwriting, and decided in favor of the upright letter, which, by obliging the scholar to form perpendicular strokes on lines placed parallel to the line which

¹ Dr. George M. Gould. Visual function the cause of slanting handwriting; *Medical Record*, April 22, 1905.

unites his eye-pupils and to the edge of the desk, compel him to hold his body straight. We must confess that these reproaches are fully justified in schools where the furniture is faulty, as I have seen for myself in a recent visit to one of the normal schools of Mexico.

However desirous masters may be to keep the scholar in an upright position, as recommended by good penmen, yet, if the height of the bench and that of the desk are not in proportion to the child's age, and if they do not preserve what is called "the minus distance," that is, with the edge of the seat under and to a certain extent inside the edge of the desk the scholar will necessarily have to adopt a bad posture, no matter what kind of writing he may be doing.

As the centre of gravity of the trunk is in front of the tenth dorsal vertebra, the body will only be at rest, in a sitting posture, when the perpendicular which passes through it falls on the line between the two seat-bones. Any movement which displaces this centre, either forward or backward, will make equilibrium unstable, and in order to preserve the position it will be necessary to seek a third point of support, which will be either forward, the top of the desk with the elbows upon it, when the pelvis muscles get tired, or backward upon the coccyx, when the scholar has not a seat with the proper conditions.

When the distance between the desk and the bench is plus or positive, that is, when the edge of the seat is outside of the perpendicular falling from the front edge of the desk, then the child must of necessity lean his whole trunk forward, and, if he is writing, support his left elbow on the desk while his feet go backward. The vertebral column is then partially turned, it does not support the head, the entire weight of which falls upon the muscles of the neck; these soon become tired, and then come into play those of the back, which in their turn get tired and let the trunk fall forward and downward between the shoulders whilst the head bends over the desk and the eyes approach too near the paper. This posture the French call diving, *plongeon*, and is peculiar not only to desks with a plus distance but also to those which have too high a bench or the top too low for the child's height. When the table is too high, the two arms cannot rest on it, at the same time, without forcing the shoulders upwards, and it is necessary to lower the left elbow and raise the right, thus producing the scoliosis of which we have spoken.

If, on the other hand, the child be seated on a bench for one, the height of which is regulated according to his size, the upright pose of the body will be the most natural and comfortable one, and will be maintained without fatigue; the two forearms will easily rest on the table whose slope of 10 degrees will allow greater facility for writing

and reading without forcing the shoulders. It is then indifferent, from a hygienic standpoint, whether a sloping or a vertical handwriting be adopted, for, in both cases the body is kept straight, a very important consideration from our point of view. Considering, however, as the expert penman Sr. F. Vergara has observed, that sloping letters on paper inclined at 20 to 30 degrees with respect to the edge of the table are more natural, convenient and easy to write, because, then, the right elbow remains almost stationary and represents the centre of the arc of a circle. It may be better to adopt sloping letters, for then, the strokes, sloping as regards the line, are, in reality, perpendicular to the breast and the line to which unites both pupils, so that *upright letters are made on sloping paper*.

Handwriting which is upright or perpendicular to the line, with the paper placed straight before the scholar, is technically harder to write, for if he keeps his right elbow on the desk the movement of the hand is very much forced when beginning a line, and it is necessary to keep displacing the elbow, and if the latter is lowered and the forearm approaches the body he must go on displacing it as he continues his line, a troublesome and tiresome task.

Besides, upright letters are not sufficient of themselves to insure an upright posture of the body, notwithstanding the well known formula of Mrs. George Sand: *Ecriture droite sur papier droit corps droit*; an upright body is not obtained by the form of the letters, but by the union of all the conditions in the desk so as to make the posture physiologically upright, easy and comfortable.

Does this mean that sloping letters, because easily written, are always to be preferred to upright ones? By no means. If sloping letters are more easy and natural when the desk and seat are at a proper height and when the light is good, the case is not the same when these conditions have not been exactly complied with.

The three or four sizes in which desks are generally made are too rigid models for the many different sizes of the children. Besides, they have the defect that as the desk and seat are movable separately, masters do not screw them firmly to the floor, their distance is constantly changing, and for this reason a good permanent minus distance is very difficult to obtain. The ideal desk is one for a single child with lateral supports which can be raised or lowered so as to adjust the two parts according to the child's size, and to remain fixed in their reciprocal relations and firm on the floor.

When a desk is defective either on account of a plus distance or because the table is too low, it is preferable for the children to write vertical letters on straight paper. In this case, although in the diving

position, upright penmanship is more hygienic because it not only tends to keep the vertebral column straighter but the head also straighter and consequently the eyes too are kept straighter. It is sufficient in fact, as I practically proved with various children in the Normal School of Mexico, to change upright letters for sloping, by inclining the paper, to get at once the child's right elbow to advance and the head to incline to the left, so that the strokes of the letters may be perpendicular to the line which unites the two eyes. Under such conditions the proximity to the paper is too great, and the left eye is much nearer than the right, which accounts for the greater degree of myopia in the left observed by several European ophthalmologists. In this case it is better for the scholar to take the trouble, when making upright letters to keep constantly moving the forearm so as to follow the line and not to bend the vertebral column nor incline the head to one side. The same thing happens when the desk is too high, for then the children have a great tendency to take a diagonal posture with the right side in contact with the desk. In forming vertical letters it is necessary, however, that masters should take great care that the paper be placed in the center of the desk and not carried to the extreme right of the child, for then the posture is still more unhygienic than in the diving position; the vertebral column is bent towards the right, the eye muscles, in order to follow the line placed far to the right, have to make a great effort, and the head also has to be turned to the right to alleviate them to some extent.

Even when the desk is perfect and the light well directed and in considerable quantity, yet masters will have to exert themselves to make certain children maintain an upright position.

In the case of some children, bad postures are due to bad habits acquired formerly, in others, they are the results of defective sight, myopia and especially astigmatism, which oblige the child to approach abnormally near in order to get clear images. It is needless to say, that, in this case, no improvement can be made unless the defects of sight are corrected by glasses adapted to remove the near point further from the eyes.

Another very important consideration, when treating of sloping writing, is, that the inclination of the left-hand edge of the paper to the edge of the desk should be as near as possible 90 degrees. In fact the smaller this angle is, the greater is the propensity to advance the right elbow on the table, to incline the head and turn it to the left, which brings with it the detestable diagonal position already spoken of.

To sum up:

- I. The bad postures of children while writing are due to the bad

adaptation of school desks rather than to the kind of handwriting adopted.

II. When the conditions of light are good and when the scholar is properly seated at a single desk specially adapted to his size, sloping handwriting on inclined paper (which is really upright handwriting — with respect to the line which unites the pupils — on sloping paper) is the most convenient and easy to write.

III. When the desk is faulty with a plus distance and the top is too low or too high, it is better to use upright letters on upright paper, which allows the trunk to keep straighter and the eyes equidistant from the plane of the desk.

IV. It is necessary to avoid having the paper on the extreme right of the scholar, as this is very injurious to the sight. Masters are recommended to place the paper in the center, forming the largest angle possible with the edge of the desk.

V. Children who suffer from defects of refraction, which compel them to approach too near the paper, cannot maintain a good posture even with irreproachable desks, but should have these defects of sight corrected by proper glasses.

THE DISSEMINATION OF TUBERCULOSIS AS AFFECTED BY RAILWAY TRAVEL.

BY DR. CHARLES B. DUDLEY, ALTOONA, PA.

Not a few times during the past years, and especially in this Association, the railroads of the country have been called quite sharply to account, for their shortcomings in sanitary matters. Both in papers prepared for the purpose, and in the discussions which have followed, the indifference, to use a mild word, of the railroads, to the public health, has been pointed out, and in some cases pictures of conditions have been drawn, which have had a tendency to arouse in the minds of the traveling public, a belief that the railroads were potent disseminators of disease. The lack of ventilation, the lack of cleanliness, the failure to provide spittoons, the disregard of proper precautions in the cleaning of cars, both en route and at terminals, the failure to disinfect, the use of upholstery and carved or molded surfaces, instead of plain, smooth ones, the color of the hangings and blankets in the sleeping cars, the failure to properly care for the bedding appliances in these same cars, the failure to properly regulate temperatures in inclement weather, the fact that people affected with a communicable disease, may at times be on cars with healthy people, the use of water and ice that may be contaminated, the possible danger from the common drinking cup, and the scattering of excreta along the track, have all been pointed out, and sometimes in language not too courteous, as sanitary sins, for which the railroads were more or less responsible. Indeed, it is perhaps not too much to say that many ordinarily well informed people, by virtue of this agitation, have been led to believe, that to take a trip on a railroad car, was equivalent to incurring a serious personal risk to their own individual health.

In view of this state of affairs, it has seemed wise to spend some little time, during the past two years, in trying to get as positive and definite information as possible, as to how seriously these various lapses from good sanitary practices, do actually threaten the public health. While other communicable diseases have not been ignored in these studies, and while considerable data and information have been accumulated in regard to several others, the principal study has concerned itself with tuberculosis, and the dissemination of that disease as affected by railway travel. Tuberculosis being a very general term, it would

perhaps be more correct to say that what will follow applies more definitely to that form of tuberculosis which affects the lungs and which is supposed to be disseminated by means of sputum.

It is obvious we think that the railroads can hardly in fairness be held responsible for the dissemination of a communicable disease, when such dissemination is a resultant of the meeting of the diseased with the healthy. This may not seem absolutely apparent at first sight. It may be thought and urged, that the railroads have no right to expose their healthy passengers, to danger of contracting disease from others, and that they should exclude from their cars, all people affected with communicable diseases. Indeed such demands have been made upon the railroads. It has been claimed that every person affected with certain diseases, for example, smallpox, diphtheria, whooping cough, typhoid fever, consumption, etc., etc., should not be allowed to travel in the cars on a railroad. But the unfairness of such a demand will, it is thought, be evident after a few moments' consideration. While it is undoubted that the railroads have a right, and for that matter do exclude from their cars, people *known* to have contagious diseases, such for example, as smallpox, it is entirely evident that the exercise of this right depends on correct diagnosis. To refuse transportation to a person or persons because they were suspected by the ticket agent or conductor of having a communicable disease, might entail serious consequences. Railroads are common carriers, chartered under the laws of the various states, given under those charters certain extraordinary powers, and at the same time by virtue of those same charters, required to perform certain public duties, prominent among which are the transportation of persons and property. It is not possible to refuse transportation except under certain well defined conditions; and since neither ticket agents nor conductors, are or can be from the nature of the case, physicians, it is difficult to see how, at least under present legislation, transportation is to be denied to even those who may be affected with communicable diseases. The proper remedy for the state of affairs described, if any remedy is possible, would seem to be in legislation, making it a crime for those affected with certain communicable diseases, to ask for or accept transportation from common carriers.

To apply this reasoning to the subject in hand. It seems clear that if the tröpschen theory of the dissemination of tuberculosis, advocated by Flügge and his school, be accepted as the potent means of the spread of this dread disease, the railroads cannot fairly be regarded as responsible for its dissemination. This tröpschen theory, as is well known, considers the minute little droplets, or finely atomized portions of the sputum ejected during the act of coughing by a consumptive patient,

which atomized material may be taken up by the healthy, who are near the consumptive at the moment, as the principal cause at least, of the dissemination of the disease. In few words, according to this theory, personal contact or nearness to a consumptive, during the act of coughing is the condition which most largely contributes to its dissemination among the healthy. As already stated, if this theory is correct, it is difficult to see how under present conditions the railroads can be held responsible for the spread of the disease.

But it is to be confessed that the tröpschen theory is not universally accepted. Indeed if we read rightly, not finely divided fresh sputum, but pulverized dried sputum, floating in the air, is generally believed to be the most important means by which the disease is spread. The literature of hygiene is full of statements to this effect, and it is not necessary here to recapitulate them. If now pulverized, dried sputum is as potent as is believed, then it will be urged, surely the railroads have important duties in the premises.

Taking up this view of the case, it may be permitted to say that the time and study we have been able to bestow on the subject, lead to the view, that the dangers from infection, due to this cause, have been very greatly magnified, and that so far as the railroads are concerned, there is very little evidence that the time spent by the ordinary passenger on either day coach or sleeping car, cuts any figure in the acquisition of this disease. The following points seem to us to have some weight in sustaining this view:

(1) It seems to be generally acknowledged that what is usually termed "prolonged exposure" is essential, as a general rule at least, for tubercular infection. It is hardly possible for one who is not a physician to go into details, and expand a point of this kind, and it is probably sufficient to simply mention it. But even the longest railroad journey, in intimate relations with a consumptive, could hardly be regarded as meeting the requirements of prolonged exposure, as they are commonly understood by the profession.

(2) Tuberculous sputum is extremely difficult to dry. If we are right ordinary exposure to air currents does not readily convert this material into a condition sufficiently dry so that it is easily pulverized. Moreover, in most of the experiments made to prove the virulence of dried sputum, the material was artificially dried, at higher temperatures than prevail in the places where sputum is usually deposited. Still further, if we are rightly informed, attempts to dry sputum for purposes of experiment either in the direct rays of the sun, or even in diffused sunlight, not infrequently results in sterilization of the material.

It is not so easy to get virulent sputum dry enough to be readily converted into fine dust. But again —

(3) Even though the material has been sufficiently dried, it is extremely difficult to pulverize. The dried sputum is more or less tough, tenacious and glue like. It is well known that in laboratories where this material is being pulverized for purposes of experiment, it is customary to put sand in the mortar, along with the dried sputum, to assist in reducing it to a fine state of division. Cornet, who has made many experiments with dried sputum and published a good deal on the subject, gives some testimony on this point, which is quite pertinent. He says:

“Any one who has himself tried to rub the well dried sputum into atoms and to pulverize it very finely will agree with me that it is no easy task to produce a really fine powder which remains suspended in the air for some time. The strong statements that have been made up to now, that one has only to rub the foot on the dried sputum to raise immediately a cloud of dust of infectious germs, are absolutely false.”

Still further —

(4) Even sputum which has been artificially dried, and is then beaten and rubbed up into dust from the carpets on which it was, readily falls to the ground. The viscous material in which the tubercle bacilli are imbedded in sputum, is relatively heavy, even when dried, and in fine state of division. Heymann's experiments seem to indicate that with the possible exception of where the disease germs are attached to very minute fragments of cotton or linen fibre, the power of the pulverized sputum to remain floating in the air, is very small. In almost every case, even where the attempt was purposely made by artificial means to cause the artificially dried material to float in the air, after ten minutes, none remained suspended, and in some cases ten minute experiments gave negative results. Finally —

(5) It is hardly fair to ignore the effect of light and air upon the vitality of this form of disease germ. A couple of days of strong light, and four or five days of even diffused light, are believed to be sufficient to largely at least, sterilize tuberculous sputum, and since a railroad coach from its construction, being long and narrow, and largely windows, offers the best possible opportunities for the action of light and air, it would seem that the chances for the long continued vitality of these bacilli, about which so much has been said, would, in these vehicles be very much diminished.

The experimental data on which the above statements in regard to the characteristics of tuberculous sputum are founded, have all been examined in their original form as published. Most of the data will be

found in the *Zeitschrift für Hygiene*. The best resumé of the subject in English with which we are conversant, will be found in the little book, "The Prevention of Consumption," by Alfred Hillier, Secretary of the National Association for the Prevention of Consumption, (London), and published by Longmans, Green & Co. Doctor Hillier gives quite a number of references to the original sources of the information which he communicates, and in view of this, it has not been thought wise to load this paper with references. The latest edition of "Bacteriology and the Public Health," by Geo. T. Newman, (P. Blakiston, Son & Co.) may also be consulted with great advantage.

But there is another phase of this subject of the dissemination of tuberculosis by railway travel, that will perhaps bear a few words. If railway coaches and sleeping cars, are as much of a menace to the public health, as we have been led to believe, would it not seem that this fact would appear in its influence on the health of those railroad employes, who from the nature of their occupation, spend quite a portion of their lives on these cars? In other words, if there is great danger of infection with tuberculosis by reason of the contaminated condition of passenger coaches and sleeping cars, ought we not to expect to find many cases of consumption among passenger train conductors, passenger brakemen, sleeping car conductors, and especially among sleeping car porters, who are supposed to be naturally predisposed to the disease, and who from their occupation spend more time in and are brought more intimately in contact with, the supposedly dangerous bedding, hangings and dust arising from sleeping in these cars, than any other people? These questions being suggested, we immediately began to search for information that would if possible throw some light upon them, and enable answers to be given one way or the other. Fortunately we are not entirely without data.

It is perhaps well known that during the taking of the last census, that for 1900, in the United States, in certain areas, known technically as the "registration area," data were obtained in regard to the number of deaths per 100,000 of population, during the census year, from consumption, and at the same time the occupation of those having passed away was given. Doctor George M. Sternberg in his recent book, "Infection and Immunity," gives the following table showing this data:

Average deaths from Tuberculosis for the whole Registration Area, per 100,000	187.8
Ditto for Bankers, brokers and officials of companies.....	92
" Laundresses	94
" Farmers and farm laborers.....	111.7
" Clergymen	123.5

Ditto for	School teachers, female.....	126
"	School teachers, male.....	144
"	Railroad employes	129.8
"	Dressmakers and seamstresses.....	130
"	Policemen	136.7
"	Lawyers	139.9
"	Mill operators	144
"	Physicians	158.8
"	Gardeners and florists.....	186.6
"	Journalists	188.4
"	Carpenters	231
"	Masons	293
"	Book-keepers and clerks.....	308
"	Painters and glaziers.....	319
"	Servants, female	319.7
"	Sailors and fishermen.....	333
"	Barbers	334.9
"	Cabinetmakers	359
"	Laborers	370
"	Servants, male	430
"	Printers	435.9
"	Cigarmakers	476
"	Marble and stonecutters.....	540

It will be noted that so far as these figures prove anything, railroad employes suffer quite considerably less from consumption than the average of the community, and indeed that they are only surpassed in immunity by five other callings in a list of twenty-seven occupations. On consulting the original data in the census reports it was found that just exactly what is covered by the term "railroad employes" was not as definitely stated as could be desired, but in view of the fact that separate headings are given for officials of companies, for book-keepers and clerks, for carpenters, masons, painters and glaziers and cabinet-makers, it seems perhaps fair to conclude that probably what are technically known in railroad language as "shopmen, clerks and officials, were excluded, leaving the train employes, both freight and passenger, and probably the track force, to make up the bulk of those enumerated as railroad employes. Whatever the limitations of the term, it is evident that this data, as far as it goes, does not indicate that railway travel, at least so far as it influences the health of the most exposed employes, is any serious factor in the spread of tuberculosis.

But again, official letters have been written to the Pullman Company asking for any information that they might have on this problem. Unfortunately, the Pullman Company have no statistics, but they say in writing that they have a large number of conductors and porters whose time of service in their employ has been continuous for a number of

years, and that they have never known of either a conductor or porter acquiring any disease on a car, except one case of smallpox. Furthermore, personal conversation with a number of the oldest conductors, many of whom have been personally known to the writer for many years, and some of whom have been twenty years in continuous service, has failed to find one who has known of a porter who had consumption, even among those longest in the service. It should perhaps be confessed that this data is not as definite as could be desired, but does it not seem fair to conclude that if either coaches or sleeping-cars were anything like as potent as many would have us believe in disseminating "the great white plague," it would be impossible that employes who spend so large a portion of their lives on these cars, would apparently so completely escape it. In other words, if these cars are so great a source of danger it would seem almost incredible that there would not be enough of the employes taken with the disease so that it would attract attention.

We fancy it will be urged, and indeed it has already been brought forward by some, who maintain the view that railroad cars are a menace to the public health, that there is a very good reason why railroad employes do not acquire the disease on cars, and that is that these men are vigorous and robust and well calculated to resist; that only such men can stand the hardships of railroad life. But it seems to us that this argument is a two-edged sword, which cuts both ways. It must be remembered that railway trainmen are, from the necessities of the case, subject to great irregularities in the taking of food and rest, are many times subject to long-continued strains and exposure, with insufficient food, and that these things are believed to be among the most potent causes that favor the onslaught of that form of tuberculosis known as consumption. Moreover, this view is confirmed by the records of the Pennsylvania Railroad Company Relief Fund, which show that the freight conductors and brakemen are actually more subject to tuberculosis of the lungs than are passenger conductors and brakemen, it being well known that freight trainmen are more irregular in taking food and rest and subject to greater hardships than the corresponding passenger trainmen.

Perhaps the most definite statistical record we have on the probable danger of infection from railway cars may be drawn from the records of the Pennsylvania Railroad Company Relief Fund already referred to. This fund is, as is well known, a beneficiary organization, contributed to by both the employes and by the company. It now numbers over 80,000 members. Its benefits consist principally in payments from the fund, known as "sick benefits," "accident benefits," and "death

benefits," that is to say, if a member of the fund is disabled by sickness he receives for a period of time from the fund weekly payments, the amount of the payments depending on his grade in the fund; if disabled by accident, a larger amount is paid, and at death a lump sum is paid his family or heirs. The organization of the fund involves a corps of surgeons who examine and certify the applicants for benefits, and very full statistics are kept. The fund has now been in operation eighteen years; all employees who desired to join being taken in without physical examination at the start. Later, physical examination, somewhat after the manner of insurance companies, was made a prerequisite of membership. The records now embrace over 350,000 cases of what is technically known as "disablement," which means that the man is sufficiently unfit for active duty so that he is entitled to benefits. These records have recently been carefully gone over, with the idea in mind of finding out what they show in regard to tuberculosis. The figures actually obtained are as follows:

Average disablement from Tubercular disease during the eighteen years of the records.....	230	per 100,000	per annum.
Ditto for Passenger Conductors	330	"	"
Ditto for Passenger Brakemen	120	"	"
Ditto for Freight Conductors	400	"	"
Ditto for Freight Brakemen	170	"	"

It will be noted, first, that both passenger and freight conductors show a higher disablement rate than the average of the whole fund; second, that both passenger and freight brakeman show a lower disablement rate than the average of the whole fund; third, conductors, both passenger and freight, show a higher disablement rate than brakemen; and fourth, as has already been stated, the passenger conductors and brakemen show a lower disablement rate than the corresponding grade of employees in the freight service. It is believed that at least two of the above rather anomalous results are easily understood when it is known that both passenger and freight conductors are among the older employees and that probably most of them were taken into the fund at its inception, without physical examination. This will explain why the conductors show a higher disablement rate than the average, especially when it is known that the growth of the fund has been much more rapid during the later than during its earlier years. The large accessions during later years, of members who had passed a rigid physical examination, have brought the general average down. Second, the brakemen, both passenger and freight, are very much younger than the conductors, and a very much larger number of them have passed the physical examination. They should therefore show a lower disablement

rate than the older conductors. The main point, however, as applying to the possible dangerous condition of passenger cars in the matter of the dissemination of tuberculosis, is that the disablement of passenger conductors and brakemen is actually lower than that of the freight conductors and brakemen. If passenger cars are as dangerous as has been supposed, we would expect the reverse to be the case.

It may not be amiss to add that the records of the Pennsylvania Railroad Relief Fund show something also in regard to the death rate from tuberculosis of the employes we are studying. During the earlier years of the fund many employes who developed tuberculosis left the service and were lost sight of, so that the data of those years are imperfect and do not represent the facts. But during the last four years all cases have been covered and the figures show as follows:

The death rate from Tuberculosis of all members of the Fund has been.....	90	per 100,000	per annum.
Ditto for Passenger Conductors	77	"	"
Ditto for Passenger Brakemen	52	"	"
Ditto for Freight Conductors	100	"	"
Ditto for Freight Brakemen	67	"	"

Here again, as in the previous case, the danger of tuberculosis, as measured by the death rate, is less for the passenger trainmen than for the freight trainmen, and in this case the passenger trainmen, both conductors and brakemen, show a lower death rate than the average of the whole fund. We think it is fair to say that the value of figures of this kind is the greater the more carefully they are kept and the longer the period of time which they cover, but it is certainly difficult to draw from these figures anything that indicates that passenger cars are a serious source of danger to the public health so far as tuberculosis is concerned.

So much space has already been taken by what has preceded that it is only possible to refer briefly to the extremely valuable paper by Dr. J. J. Kinyoun, of Glenolden, Pa., on "The Bacterial Content of the Railway Coach." We wish it were possible to present here a full abstract of that paper. It is apparently the first real careful work done, at least in this country, in trying to get positive knowledge of the actual conditions of railroad coaches and sleeping-cars as to their liability to disseminate disease. There is, however, less occasion for regret that we are able to say so little about that paper, since it was published in full in the *Medical News* of New York, for July 29, 1905. We may, however, mention that out of fourteen examinations of carpet dust from cars, many of which were known to have carried tuberculous people, none showed the presence of the tubercle bacillus; out of sixty-four examina-

tions of dust collected by means of swabs from the interior surfaces of similar cars, including seats, bedding, curtains and woodwork, only one showed *bacillus tuberculosis*, and this was doubtful; out of ninety-six examinations of air from similar cars, only one showed *bacillus tuberculosis*; and out of twenty-one bacterial examinations of material obtained from drinking cups none showed this same bacillus. Dr. Kinyoun is very modest in his paper, and calls for more work along this line; but we cannot help feeling that a careful perusal of his paper will give very little comfort to those who think that sleeping-cars, even those engaged in transporting tuberculous people to sanitary resorts, are a serious element in the spread of this disease.

This brings us, in conclusion, to a few experiments of our own which have given results so contrary to the teachings which at present prevail in regard to their subject matter that we almost hesitate to bring them forward. After quite a little thought we have, however, concluded to do so, with the hope that others will repeat them and either show where we are wrong or confirm our data, and thus help to modify the present trend of hygienic teachings upon this matter.

It is well known that there has been and apparently is now a general belief among sanitarians that the upholstery of passenger coaches and sleeping-cars was a serious menace. The outcry against upholstery has embraced the hangings, the carpets and the plush coverings for seats and the blankets in sleeping-cars, and the plush on the seats and the carpets or mattings in the aisles of passenger coaches. The philosophy of this outcry seems to be that smooth, hard surfaces are easily cleaned while upholstery of all kinds is not easily cleaned, and may serve to retain tuberculous sputum as a constant menace to those who are brought in contact with it. On the other hand, it occurred to us that plush, carpet and the various upholstery in use in passenger and sleeping-cars might retain the infectious material much better than a bare, smooth surface, and that there might be less danger both of the material becoming dried and of its being stirred up into the air from a carpet or from upholstery than if smooth, hard surfaces only were present.

In order not to have this matter wholly a question of opinion, the following experiments were carried out: The resources of our bacteriological laboratory not enabling us to experiment with tuberculous sputum, some flour paste of about the thickness of tuberculous sputum was made, putting into the paste a certain amount of common salt in order to have in it something which was measurable. This paste was put in equal amounts on, first, pieces of glass; second, pieces of carpet; and, third, pieces of plush. The three series of objects were then allowed to dry in the air. It was found that the paste on the glass dried more

readily than on the plush or the carpet, which is what would be expected from previous experience with the hygroscopic nature of fabrics. The drying in the air was so slow, however, that ultimately all three series were dried artificially over the steam table. After they were thoroughly dried, a heavy iron roller was passed over each one of them the same number of times, the idea being to simulate the conditions of grinding up tuberculous sputum under the foot. Some of the samples were then put in the window, to be subjected to the wind, so that it might blow away as much of the material as it would, and some were put in a box and blown upon with compressed air. The three kinds of samples were treated exactly alike in all of the experiments. After all the pulverized material that it was possible to remove by the compressed air had been blown away, each of the three kinds of articles was carefully washed and the amount of material left behind in each case, as measured by the salt, determined. The average of a number of experiments showed as follows: On the glass 64.60 per cent. of the paste had been blown away, while on the plush and on the carpet only 12.50 per cent. had been blown away. These figures can be stated in another form. On the glass a little over one-third of the material stayed behind, while on the plush and on the carpet seven-eighths of it stayed behind.

We cannot help feeling that these experiments point very clearly in the direction that the danger of infection from upholstery in Pullman cars and coaches is very much less than from naked surfaces, and that the crusade against hangings and carpets and plush is not founded on careful experimental data.

It gives me great pleasure to acknowledge my indebtedness to M. E. McDonell, bacteriologist of the Pennsylvania Railroad Company, for assistance in the preparation of this paper.

A FEW POINTS RELATING TO CAR SANITATION.

BY H. M. BRACKEN, M. D., ST. PAUL, MINN.

The question of car sanitation is one that is interesting railroad officials and the traveling public in general to a great extent at the present time. Undoubtedly there are many unsanitary conditions pertaining to cars that exist and will continue to exist for a considerable period of time. Sanitary mistakes cannot be corrected in a day. It is not possible for any railway company to throw away or to make over within a short time a large proportion of its passenger coaches. Such extravagance would ruin a company. It is a safe statement that railroad officials are keen to make improvements in their methods of handling passengers.

In order to advance car sanitation it is not only necessary to improve the methods of car construction, but to instruct railway employes in the proper care of cars. Specific duties should be imposed upon them as to car ventilation, car cleanliness, etc. Their instructors should be medical men connected with railway companies and familiar with sanitary problems. At present the only class of medical men connected with railways are the railway surgeons. So long as this condition prevails, these men have a responsibility resting upon them beyond that of a surgeon. A few are in position to assume the responsibilities of a sanitarian, but too often the railway surgeon is only an appendage to the claim department of the road which he represents, and he is then apt to consider it his chief duty to aid such department in saving money, rather than to instruct the company in the judicious expenditure of money for sanitary purposes.

In soliciting information bearing upon car sanitation I have received many replies from railway surgeons that were highly amusing, though not instructive. These replies have shown an entire absence of sanitary knowledge, and at the same time an utter indifference to such matters. This criticism does not apply to all railway surgeons by any means, for there are some excellent sanitarians among them who are quite alive to the sanitary needs of the roads which they represent. The best information relating to car sanitation is to be obtained from the heads of the mechanical department of the various roads. These men are as a rule, thoroughly familiar with the sanitary requirements of passenger car service, and are ever ready to investigate new methods

which appear to be improvements over present methods which they recognize as deficient or absolutely useless. The railway surgeon, or some other medical man, if the surgeon is not interested, should be in close touch with the mechanical superintendent in dealing with car sanitation. It is a good plan to mix science and mechanics when sanitary problems are under consideration. It is a great credit to the mechanical superintendent that so much has been accomplished in car sanitation in spite of the lack of co-operation (or even opposition) on the part of railway medical men.

Let us consider briefly a few of the points that deserve our attention in relation to car sanitation at the present time:

1. *Spitting upon the floors or furnishings of cars.* All decent people recognize this as a foul, disgusting and unsanitary procedure, yet it is a common thing to see persons spitting upon the floor not only in the smoking cars, but in the day coaches. The railway companies in the United States that provide spittoons for their smoking cars can probably be counted on the fingers of one hand, yet it is well known that a certain proportion of those who travel in smoking cars *will* spit, if not into spittoons, upon the floor. Why, then, have those responsible for car sanitation not devised some kind of a receptacle into which these spitters may spit? A short time ago a gentleman asked me to look at the pattern of a spittoon which he had devised to be placed in the floor of cars. He stated that for some time he had been traveling in the South where it seemed to be a necessity for men to spit, and that these men when traveling in cars where an order was posted against spitting were compelled to spend much of their time on the car platform or at an open window. The tobacco chewers are not the only offenders, however, when expectoration on the car floors is under consideration. The hawkers of bronchial, nasal or tubercular sputum are most disgusting.

It is not necessary that every traveler should be classed as an offending expectorator, but it is necessary to recognize the fact that there are travelers who will not observe the rules of decency and for those should be provided a receptacle. This means that not only the smoking cars, but the day coaches as well, should be provided with such necessities. Notices should be posted in the cars, forbidding spitting upon the floor or furnishings, and the trainmen should be required to enforce these sanitary regulations. Such regulations would apply to the trainmen as well as the passengers.

The spitting nuisance in cars can and should be abated at once.

2. *Car Cleaning.* More attention should be given to this subject. Since the introduction of compressed air a certain amount of cleaning

of cars and car furnishings has been carried out by this means, but the compressed air outfit is a part of the car-cleaning equipment in but a small proportion of car cleaning yards. Even when it is installed its use is governed somewhat by weather conditions, for in many of these places there are no sheds under which to carry on the cleaning during stormy weather, and as it is out of the question to clean cars by means of compressed air unless the car windows are open, this method of cleaning is hardly practicable in very cold climates during the winter season when the coaches are equipped with storm windows. It is to be hoped that in the near future the use of the vacuum system may become quite general, for with this it is possible to clean a car and its furnishings thoroughly without regard to the weather conditions.

A car will become dusty and dirty while in service. For the cleaning of such cars, some method should be devised that will be a radical improvement on that now so generally in vogue of sweeping the floor with an ordinary broom and dusting the seats with a feather duster. The floors of cars in service should be sprinkled with some damp material and should be cleaned with a long handled brush rather than a broom. A porter should never be allowed to use a dusting broom in cleaning a car in service, nor should he be allowed to dust off the passengers in the body of an occupied car. For cleaning the furnishings of the car the porter should be required to use a damp cloth. It may be said that a damp cloth is not suitable for dusting plush seats. Granted. In reply it may be said that plush, tapestry, velvet, cloth, etc., are not suitable for car upholstery. I appreciate the objections to cane and leather as car seat coverings, but still I am disposed to think that the time will come when these will be used a great deal more than they now are. One has but to note the amount of dust in an ordinary plush car seat during the summer season to realize that a non-dust collecting surface, a surface that could be wiped off with a damp cloth, is a far superior material for car upholstery. Leather is used in the upholstery of chairs in the smoking compartment of "library" coaches. If suitable for these, it certainly can be made suitable for the upholstery of seats in the ordinary coaches. It is noticeable that the heavily upholstered chairs of parlor cars are in many instances giving place to the lighter, more airy and cleaner openwork chairs that have but little upholstery, in fact, no upholstery further than a movable cushion. While we are in the transition period for ordinary car upholstery, it should be most positively stated that plush or similar textural material should not be tolerated in smoking cars.

Great improvement has been made in the construction of the most recently built cars, for rough surfaces have been done away with to a

great extent, thus lessening the tendency to dust collection. But there is opportunity for still further improvement along these lines. It may not be practicable to displace the ordinary roller shade with washable curtains hung from a rod, but if not, the shade box over the windows which is a great dust collector should be so constructed as to be more easily cleaned than it now is, and the shades should be made of non-dust collecting material.

I presume there would be a general outcry against the withdrawal of carpets from all cars, yet such should be done. Certain it is that carpet strips should be abolished from the aisles of the day coaches. If carpets are still to be used in sleeping cars, parlor cars, etc., I presume they should be, as they now are, heavy in texture but easily removable for cleaning.

The cleanliness of the cars could be greatly increased if newsboys with their edibles were entirely banished from passenger trains, for one of their chief functions is to sell goods to passengers, the refuse of which soon becomes an unsightly collection of filth in a car that is in service for any length of time.

Drinking water for cars should be of unquestionable quality — distilled or equally pure, should be kept out of the reach of passengers except as drawn from the faucet, should be stored in well cleaned cans or coils and iced with well selected ice that has been handled in a cleanly manner.

There is certainly room for improvement in the toilet rooms of the day coaches. It is not necessary to outline in this paper how such improvement should be brought about. Suffice it to say that toilet rooms should receive attention at once. The toilet room of parlor and sleeping cars should also be made subjects of careful study. At present they are disappointing to say the least. Neither the closets nor the toilet rooms themselves are properly ventilated. Many of the sleeping cars start out from railroad centers with their toilet rooms in a malodorous condition. This, in all probability, is because of imperfect cleaning. Such a condition should not be tolerated.

In no cars are the possibilities greater for improved sanitation than in the sleeping cars. The owners of these elaborate and highly profitable coaches will tell you that everything possible is being done to improve conditions. Travelers are not always disposed to agree with this assertion. We may mention a few points for improvement as follows:

- (a) Securing a better material for upholstering the seats.
- (b) Dispensing with dust from the porter's brushes.
- (c) Doing away with wooden pillow boxes and thus tending to lessen the probability of the presence of vermin.

- (d) Exchanging the present heavy berth curtains which hang from the top of the car for individual berth curtains of washable material that should be cleaned at the end of each trip. With separate curtains for upper and lower berths, the curtains for the upper berths should never be hung except when the berths are to be occupied. This would permit of a greater air space in the body of the car during the night.
- (e) Better ventilation of the entire car.
- (f) Better dressing rooms. The old smoking and dressing room combination was bad enough, but now in the best trains where all the smokers are consigned either to the "library" or "observation" car, the dressing room for men instead of holding its old space has been cut down in many instances until it is a most inconvenient place in which to dress. The dressing room for women is often reduced to the smallest possible area.
- (g) Proper provision for cleansing the teeth. The present necessity of cleaning the teeth with ice water, together with the general use of the drinking glasses for this purpose is an abomination that should have been abolished long ago.

A word about the compartment sleeper: The compartment has many points of advantage over the old sleeping berth. There is no excuse, however, for the regulation which requires that the door of the compartment *must be left open* when but one berth is sold, thus compelling the occupant to sleep behind curtains.

3. *Car Ventilation.* The difficulties of car ventilation have been fully exploited. Admitting that it is difficult to properly ventilate a car, it is nevertheless a fact that cars *can be* well ventilated. It is therefore simply a question as to whether the transportation companies are going to furnish us proper ventilation or leave us as in the past to breathe the foul air of a closed car during the cool and cold weather. Each day coach should be provided with a ventilating system that will furnish at least 1,000 cubic feet of fresh air per hour for each passenger in such a way as not to annoy the passengers with unpleasant draughts or currents of air. This requirement should apply to all day coaches and sleeping cars and to all street cars. Dr. Charles B. Dudley, Chemist of the Pennsylvania Railway Company, has estimated that each day coach should have at least 60,000 cubic feet of fresh air each hour. The proportion required for other cars may be easily determined.

4. *Car Heating.* When the weather is such as to require the artificial heating of cars there should always be plenty of heat, but never over-heating of cars in service. The proper heating of a car requires a reasonable number of thermometers properly placed, and competent trainmen to use them in regulating the temperature of the car.

5. *Over-crowding.* This is at times unavoidable on both the street

car and railroad systems. There is undoubtedly unnecessary overcrowding, however. The degree to which this is carried depends largely upon the temperament of the traveling public and the greed of the transportation companies.

Old Cars. Undoubtedly these must be used for a time, but some communities feel that they are overburdened with the relics not only of their own, but of other districts.

In discussing the problem of car sanitation the fact must not be overlooked that the Pullman Company has within the past year established the office of "Superintendent of Sanitation." Much good should result from this action. It is to be hoped that other sleeping car owners, as well as the owners of railway coaches and street cars, may speedily follow the example set by the Pullman Company.

Anticipating the necessity of some regulations relating to car sanitation, I sent out a circular letter asking an opinion upon four points, namely:

- (1) A sufficient amount of fresh air properly distributed.
- (2) Cleanliness of the car and its contents.
- (3) The proper heating of the car.
- (4) The over-crowding of cars.

I wish to quote from the replies of various parties who have traveled much and are able to judge of the unnecessary inconvenience and unsanitary condition connected with travel:

RELATING TO CAR VENTILATION.

(5) "I am inclined to believe that the most important point to which the attention of the Board should be directed is that of proper ventilation. I have often, when taking a train at an intermediate point between ——— and ———, been obliged to enter a car where the air was so offensive as to give me a headache within a few minutes. It would seem as tho' some means can and should be found to obviate such a condition."

(6) "A sufficient amount of fresh air is not provided in either street cars or day coaches during the cold seasons. Economy in the use of fuel seems to be considered a sufficient reason for shutting off ventilation."

(7) "The ventilation of street cars in ——— during the winter months is very poor, no provision being made for ventilation except through four small apertures near the roof of the car, and these being within the reach of the passengers are kept closed most of the time. Even when open they are of little use. I have no suggestion to make regarding better ventilating apparatus. Almost any change would be an improvement."

(8) "A sufficient amount of fresh air properly distributed is certainly wanting in street cars of this city during the cold weather. It is also true to a certain extent during the warm weather. For example: If a rain storm makes it necessary to close the windows of a car, the conductor will frequently use such car for a considerable time after the rain has ceased without opening the windows. Lack of ventilation in street cars is inexcusable at any time, particularly during spring, summer and fall when the weather is such that the windows can be left open without harm except during a rainstorm.

The porter and the sleeping car conductor seem to be rather negligent in the ventilation of cars under their care. It seems to me important that the porter of the sleeping car should watch during the night and open and close the ventilators from time to time as necessary. He might also take advantage of stops at certain stations to open the doors of the car for a few minutes and in this way aid in securing a change of air."

(11) "We know that during the winter time the street cars in ——— and ——— are most abominably foul. It seems impossible with the present system of ventilation to make the cars comfortable during the cold weather even under the most favorable conditions.

That sleeping cars are not properly ventilated, altho' as a rule they are better than street cars, I believe is a well recognized fact."

(12) "The absolute ignorance of the average porter and brakeman regarding the rudiments of proper ventilation renders travel by rail in the Northwest during the winter months exceedingly uncomfortable and dangerous to health."

(15) "I do not know anything about ventilation of cars, but I do know that day coaches in the winter time are more foul during the latter part of the day, and that the air of the day coaches where people spend the night is always extremely bad in the morning."

(17) "The ventilation of street cars is a difficult matter, but I do think it ought to be so arranged that such cars cannot be shut up absolutely tight like a box when they are jammed full of people and the atmosphere already so foul as to be actually poisonous."

(18) "The employes of these different companies should be required to give more attention to the subject of ventilation."

(22) "In sleeping cars the ventilation is always bad."

(28) "A sufficient amount of fresh air properly distributed is to be found only in our open cars."

(31) "I have had occasion to know from observation and report that ventilation is very imperfect in cars in this state, not only on steam, but also on street railway lines."

(32) "I was impressed with the system of ventilation in use by the Pennsylvania road. Whether in practice this will prove all that is necessary I do not know, but it is certainly a step in advance."

(34) "So far as I have observed, a sufficient quantity of fresh air is not uniformly admitted into day coaches and sleeping cars upon the railway lines in this state and elsewhere, and the facilities for the proper distribution of the air which is admitted are altogether inadequate."

"It would seem to me that each railway line should give its conductors, brakemen and porters proper instructions in regard to heating, as well as ventilating of the cars under their care. On most of the lines there appears to be an utter lack of instruction upon these points. One passenger will complain that the car is too cold, whereupon the steam will be turned on and the ventilators of the car closed. In a short time another passenger will complain of the heat, and this will be followed by the opening of all the ventilators. On one of the railway lines in this state a thermometer hangs on one side of the car and the men in charge are, I presume, supposed to make occasional readings and regulate the temperature accordingly, but whether or not they have any instructions on this point they rarely look at the thermometer or regulate the temperature except when the cold or the heat brings forth remonstrances from the passengers who too frequently have suffered long from the inconveniences of extremes of temperature."

(35) "In regard to the ventilation of cars: I think the practical solution would be to require that all cars built or purchased after a certain date should be ventilated in some manner approved by the State Board of Health. This would not work any great hardship and ought not to meet with opposition on the part of the railroad companies; whereas if they were required to make changes in the present cars the opposition would undoubtedly be great."

(36) "The question of ventilation and heating of cars is perhaps the most difficult problem we have to solve, and the sooner the matter is taken up by State and Provincial Boards of Health the better."

(38) "The most unsanitary condition in railway cars is that of poor ventilation."

(39) "That our railway cars are not properly ventilated is evident to every one who travels. This is apparent in the sleeping cars, but the acme of imperfect, or rather the total lack of ventilation, is to be found in the day coaches on our through trains."

(44) "A larger amount of fresh air should be secured for both sleeping and street cars."

(46) "Any one who has had the misfortune to enter a railway coach on one of our through trains at three or four o'clock in the morning must have been thoroughly convinced of the dreadful state of affairs that exists at present. The stench and foul air is often beyond description. Just how much of this is due to the carelessness and indifference of passengers is difficult to state, but certainly the conditions might be improved."

(47) "In regard to the ventilation of railway and sleeping cars: It seems to me there is a crying need for improvement both in respect to appliances and the use of same. It seems to me a little more intelligence on the part of those having the cars in charge is desirable. It is easy to complain of these things, but to remedy such conditions is another matter. I am not sure that there is a remedy except in compelling those in charge of the trains to exercise more intelligence and care for the comfort of the passengers."

RELATING TO CAR CLEANING.

(1) "Some of the cars that I have traveled in over the state have been swept out during the time they were occupied, and it has seemed to me a very poor custom. The Pullman cars are swept more or less during their journeys. Undoubtedly this is necessary, but should it be done in the way that it is customarily carried out? One road that I have traveled over quite a little, whose trains are used for continuous service, has its cars swept out at the end of the line (between the last two stations), so that they may be reasonably clean for the return trip. This has always been a source of discomfort to me. It is probably an exaggerated state of affairs which does not often occur."

(2) "It seems to me that plush covered seats should never be permitted in smoking cars. They necessarily get foul and filthy."

(4) "It has often occurred to me that one of the most likely causes of the spread of disease is the repeated use of the heavy coverings in the sleeping cars. While the sheets and pillow cases are changed each time a berth is used, blankets and pillows are used over and over again without cleaning or even airing, and I always feel when getting into a sleeping car berth as if I were taking chances on infection. It seems to me that in view of the profitableness of the sleeping car business the companies ought to be compelled to clean in some way all bed clothing in sleeping cars after each run."

(6) "The day coaches on the through trains running into and through this state are, as a rule, filthy. Very little attention seems to be given to the care of the closets which are generally about as nasty as they can be made."

(8) "In the matter of cleanliness, not much fault can be found with the street cars. Of course there are exceptions due, I am told, to the slovenliness of the conductor in charge of the car. In the matter of cleanliness of the sleeping car and contents, it seems to me there is ground for complaint particularly with reference to the closets. This is a matter in which the conductors and porters seem to take but little interest. It was only under a threat that amounted almost to personal violence that during a recent trip on a sleeping car we secured the attention of our porter to a very serious defect in this respect. The conditions on some of the second class cars is better imagined than described.

"I think that discrimination between first and second class service should not be made in railroad cars so far as relates to fresh air, cleanliness, heating and the number of persons in the car. I think that many of the defects in sleeping car sanitation could be remedied if the porters who spend much of their time loafing on these overland trips would work about eight hours out of the twenty-four in caring for their cars. It seems to me that the conductors, brakemen and porters are all in need of education along sanitary lines and that they would respect instruction most of all if it comes to them through the operating officials of the railroad.

"I believe that railroad companies ought never to be allowed to con-

vert an old plush upholstered car into a smoking car. The floor, the seats and everything about the car should be furnished with special reference to the fact that it is to be a smoking car."

(11) "As to the cleanliness of the cars: On this point the sleeping cars probably deserve more criticism than the street railway cars. The hangings, blankets and upholstery of the cars must certainly be the lodging place for large number of organisms and I think it must be true that a great deal of infection is brought about by this means. I have in mind the case of a gentleman who recently went to Nevada from ——— on a hurried trip and returning developed within three weeks after the time of his arrival here a local tuberculosis of the eyelid. This I know to be the fact from microscopical examination, the circumstances surrounding the case make it almost certain that this infection was received in a ——— sleeping car, probably from some tuberculous subject who had occupied the same berth previously."

(13) "To my mind the most important matter concerning railroad coach sanitation has to do with the care of the closets and particularly the disposition of urine and feces. There should be some device for collecting the excreta so that they may be prevented from falling on the ground. Either earth closets should be used or else a detachable can partially filled with some disinfecting solution should receive the excreta, and these cans should be removed and emptied at the end of the run. Possibly some device could be used by means of which the contents of such cans could be sterilized by steam from the engine."

(15) "There is one feature connected with the car service on the steam railroads that has attracted my attention. That is the unsanitary upholstering. The plush coverings of seats, the heavy curtains, the carpets on the floor of at least some cars seem to me to be dangerous in public vehicles. There might be wood, linoleum or similar smooth covering on the floors; the plush might be discarded and some smooth upholstering used, preferably some material that could be frequently removed and washed. The feather duster ought to be discarded and the attendants required to use wet cloths for cleaning. I would like to see our cars built upon a pattern of extreme simplicity in design, even tho' it might be offensive to the esthetic sense of our traveling public. The object should be to have cars as smooth as possible, offering little opportunity for dust to collect. I would like to have the cars finished with a hard polish, of a color that would easily show dirt and dust. This polish should be of such material as will permit of frequent washings. I think that esthetic considerations have been allowed to weigh too heavily in comparison with the sanitary requirements in car construction and equipment.

"Closets and water receptacles (for ordinary water) need to be carefully attended to. The receptacles for drinking water ought to be so arranged that the public is prevented from tampering with them. Instances are on record where dirty rags have been dropped into the drinking tanks in cars."

(17) "Cars should be so built and upholstered that they may be

washed out daily with a stream of water instead of being swept out. I think that railway officials should have it called to their attention that they should not have seats tufted or covered with plush or other materials which hold the dirt and germs. It might be pointed out to them that the traveling public would rather have clean hygienic furnishings on floor and seats than elegant, but unsanitary, furnishings, and that draperies which hold dust are an offense especially during the summer."

(18) "The closets should receive more attention, especially during long trips."

(22) "A part of the difficulty in the care of the day coaches results from the indifference or bad habits of the passengers. I believe the time will come when porters will be required for the day coaches as well as for the sleeping cars. The ordinary day coach is not, as a rule, supplied with good drinking water and the closets are not provided with means for the maintenance of ordinary cleanliness."

(29) "While it is true that it is not feasible to have closets on ordinary street cars, yet it will become necessary for street railway companies to furnish sanitary accommodations at connecting points, and on long lines to even establish proper waiting rooms with sanitary accommodations. Of course the majority of passengers on these lines only ride for a few minutes, yet it is becoming a part of the business of these street roads, especially during the summer months, to have long circuits for those who go out sightseeing. In some places these touring cars run at regular intervals, making a circuit covering from two to three hours. As sanitary officials, we know what two or three hours ride oftentimes means to those who take part in this kind of travel. In one sense every railroad, whether street or steam road, is a law unto itself and must be treated as it is found."

(30) "It should be a simple matter to have the cars kept reasonably clean and special attention should be given to the smoking cars. I notice that some of the smoking cars are now provided with spittoons, but they are not properly cleaned in some instances. I was on a car the other day and saw the porter bring in supposedly clean spittoons which I am very sure were far from such a condition. The sweeping of cars with a dry broom while the cars are in service to my mind needs correction. If it is necessary to sweep out cars while in service (and it no doubt is where long runs are made), damp sawdust or some other equally efficient agent should be used freely in order that the dust from the floor may be kept from rising."

(32) "In regard to the cleanliness of cars: We suffer perhaps in this state from lack of car cleanliness as much or more than in other sections of the country, for after the long trips across the continent the cars are very foul. Our local trains are generally kept in excellent condition, but this cannot be said of many of our street cars. The conditions in the sleeping cars generally and the toilets in the same are, I consider, an abomination. The company's rules governing the care of these cars may be all right, but their enforcement is very lax."

(33) "Some changes should be made in the upholstering of the

passenger and sleeping cars, as the material at present in use is a retentive receptacle for much dirt and dust and largely increases the difficulties in maintaining these cars in a sanitary condition."

(34) "On some of the street car lines in the state, as well as upon railway lines, the conductors and brakemen in charge do not appear to work under intelligent rules in regard to cleaning. I have a few times seen a conductor upon a street car, while his car was en route, raise a dust by sweeping the floor of the car. I have seen the same thing occur in sleeping cars, the porter raising a dust by sweeping and dusting methods which indicate lack of proper instruction in regard to the danger of unnecessarily raising a dust. The men in charge of street and railway cars in this state do not appear to be working under instructions which have been sufficiently impressed upon them."

(35) "I think all passenger cars should be kept clean, certainly cleaned once every day or at the end of every run. A very bad habit that some porters have is that of dusting the car while it is occupied. It would be much safer in my judgment to let the dust alone until the passengers are out of the car."

(36) "I have made inquiries regarding the regulation adopted by the various companies, more particularly as they relate to sleeping cars, and in reply to your question must state that, so far as I can judge, the points mentioned in your letter are not given the consideration they deserve. In fact, in many instances they are not considered at all.

"In the city of ——— I am of the opinion that under the new management the cars are dirtier than they were before. The morning cars show evidence that they have not even been swept since the previous day.

"As to the use of compressed air: I think it should be discontinued and the vacuum process used in its stead as a means of cleaning cars."

(39) "The cleaning of cars is not given proper attention. Cars are more or less perfectly cleaned at the end of long runs. There is a matter of equal, if not greater, importance than the cleaning of cars at the end of runs; I refer to the habit of sweeping the cars as a division point is approached. The brakeman goes through the day coaches and sweeps the floors without any effort whatever having been made to control the dust. These day coaches are not provided with spittoons and the tuberculous passengers, of whom there are many on trans-continental trains, spit on the floor. The sputum becomes dry and the germs are spread about rapidly enough by the passengers without the aid of the brakeman with his dry sweeping. The same condition with regard to dust prevails in the sleeping cars, tho' these are provided with spittoons, and the porter—influenced by tips—may cause less dust than is caused by the brakeman in the day coaches. The floor of the smoking car on a through train is, as a rule, most filthy. It seems to me that spittoons could be provided for day coaches at a small cost. Spitting regulations without spittoons will do no good. Cars are swept as division points are approached. This could be done at the station instead of as the station is approached, and the passengers given an opportunity to leave the car while the sweeping is in progress

and the car aired to some extent at least. This car cleaning question is one of great importance."

(40) "Regarding cleanliness: The railway companies would save money by complying with some of the requirements of hygiene. What use has the public for the expensive carpets in the sleeping cars? Berth curtains should be of washable material. This would be much more appropriate than the expensive and ill-smelling draperies now used. Plush for seats should be replaced by leather and carved wood should disappear from the interior finishings of cars. The aisle carpet in the day coaches should be replaced by linoleum or other material similar in texture, so that the whole floor of the car could be washed at terminals. Brushes and combs should not be supplied in sleeping cars."

(44) "Sleeping car bedding should be revolutionized. Why would not a strong fine quality of leather be better than plush for car seat coverings? This could be washed at the end of each trip and kept clean. Plush must be an excellent place for all kinds of filth to accumulate in. I understand that the Siberian Railway uses leather as a seat covering."

(48) "Regarding the cleanliness of cars, so far as I have been able to observe, the cleaning is usually thorough at the end of every run. The car, however, while in transit may become soiled by filthy passengers and especially through expectorators. These latter are a nuisance who will never be successfully dealt with until the American public has been taught that it is filthy to spit.

"I have seen a smoking car become so filthy from tobacco juice after a run of twenty miles that a decent person would beat a hasty retreat therefrom."

(49) "In my opinion the cleanliness of cars and their contents, as well as of the closets in same, is a most important subject, and the necessity for such cleanliness should be impressed upon the railway officials of the different states."

(50) "As to the cleanliness of cars: I have no direct evidence except that there is a uniform failure to provide sufficient spittoons, and that the toilet accommodations are notoriously bad. I think that some change should be brought about either by posting signs or by providing other accommodations, so that passengers should not be compelled to continue the present unsanitary practice of using wash basins over which to clean their teeth."

RELATING TO CAR HEATING.

(5) "The matter of properly heating the cars is more easily handled and from my observation I believe that proper attention on the part of those in charge of the train would meet the difficulty complained of in overheated cars."

(6) "Cars are either too hot or too cold, due partly to the lack of ventilation on the one hand, or too much cold air on the other, the result of throwing all the ventilators of the car open in an attempt to relieve the condition caused by having everything closed too tightly in the first place."

(7) "My chief criticism of sleeping cars is the overheating of the lower berths at night. During the cold weather this is a common occurrence and I believe it is the most dangerous of any condition encountered in sleeping car travel."

(28) "The proper heating of the car is, I suppose, a matter upon which no two groups of passengers in any one car would agree. The rule with us is to overheat, and any attempt to lower the temperature or to improve the conditions of the air in the car is bound to cause adverse comment from that class of people who prefer excremental air and the odor of superheated man."

(47) "I venture to say that at no time during the spring, fall or winter months is a Pullman sleeping car run on any road in the country with proper regard to the heating and ventilation of same. This may seem to be a rather strong statement, but I believe it is warranted. In cool weather the steam is turned on before the train leaves the station and no one appears to pay any attention to the degree of heat which is forced into the car. The result is that when the train leaves the station, the sleeping car is of about the average temperature of a Turkish bath. When the train starts, the steam from the locomotive is added to that already percolating under and through the beds, and the occupants have to submit to being parboiled or "kick." Perhaps the latter alternative would not be so bad if it ever brought about results, but in nine cases out of ten the porter will promise to shut off the steam and then forget to do so, or the car has become so completely overheated that there is but little reduction in the temperature of the berths after the porter has opened the car ventilators.

"As to the ventilation of day coaches, it seems to me that the present methods admit cinders, smoke and the various gases produced in the combustion of the coal to a far greater degree than the pure air which is so much needed. It seems to me that a little more intelligence on the part of those having charge of cars is very desirable."

(50) "So far as I know, the heating of cars is nowhere properly attended to and I think this broad statement may be made in regard to the cleaning of railway and street cars also."

RELATING TO OVER-CROWDING.

(2) "Over-crowding seems to be universal in street cars."

(4) "Over-crowding of street cars, it seems to me, is a source of danger. The vitiated air is certainly most unsanitary."

(5) "It is difficult to meet the matter of over-crowding. Still, railroad companies should be required to furnish sufficient cars to accommodate every passenger with a seat."

(6) "Over-crowding, especially of street cars, is a common complaint which can only be remedied by running cars more frequently."

(7) "I have nothing to say with reference to the over-crowding of the street cars further than that it seems inevitable at certain hours of the day in our large cities."

(8) "It is of course a well-known fact that during at least half

of the daylight hours the street cars in our city are very much over-crowded. This over-crowding is especially bad during the rainy weather when people are packed closely together in the cars with all the windows closed to keep out the rain. It seems unfortunate that persons who work indoors during the entire day should be compelled to ride so much of the time in over-crowded, illy-ventilated street cars."

(11) "Over-crowding is certainly allowed in our street cars and it seems to me that this is a source of considerable unhealthfulness. People with pulmonary, bronchial or nasal infections coming into intimate contact with other passengers in a crowded car are constantly endangering those with whom they travel."

(12) "As to over-crowding: Little, I fear, can be accomplished in the case of railway coaches. However, an effort should be made at least in the case of street cars to better present conditions. In justice to the companies we should remember the unwillingness of the American public to wait even for one minute."

(18) "The over-crowding of cars should not be permitted."

(28) "Over-crowding is with us the rule, especially during rush hours. We are fortunate if we are able to secure standing room on the rear fender."

(30) "As to over-crowding, I think that nearly half the year the trains running west of — are frightfully crowded, standing room often being at a premium. Ladies are sometimes compelled to go into the smoker in order to get a seat at all."

(34) "In some European countries the number of passengers which may be admitted to a car is effectually regulated. In this state there is always room for one more and occasionally the car has the appearance of a bough of an apple tree when a swarm of bees has alighted upon it. In the small places where cars are run at rather long intervals I presume that a regulation touching this matter of over-crowding might frequently be an inconvenience to passengers. In the larger cities, and particularly on the more congested lines of street travel, there should be no excuse for the absence of regulations in regard to this matter."

(38) "Over-crowding means bad air and an increase of filth."

(39) "Over-crowding is evident, but the natural greed of humanity, the desire to get everything possible, will probably continue this evil until legislation requires railroad and street car companies to supply every passenger with a full seat or refund transportation."

(44) "The over-crowding of street cars should be stopped, but perhaps this is not for the board of health to undertake."

RELATING TO OLD CARS.

(2) "The railway companies seem to make this state a dumping ground for superannuated, foul-smelling, illy-ventilated sleeping cars. This custom ought to be stopped."

THE DUTY OF STATE BOARDS OF HEALTH IN DEALING WITH CAR
SANITATION.

(3) "I believe that the State Board of Health should undertake to secure better sanitary conditions and should formulate and insist upon the enforcement of sanitary regulations relating to car sanitation."

(5) "I congratulate the State Board of Health upon taking up this important matter and hope that something practical and helpful to the traveling public may result from such action."

(6) "The State Board of Health can very properly undertake to improve these conditions by proper and adequate regulations, as the matters at fault are due in part to a false sense of economy on the part of the officials and to ignorance and indifference on the part of employees."

(11) "I feel that this state is to be congratulated on the attitude taken by its Board of Health on these matters and hope you may be able to do something to make our public conveyances more healthful. It seems to me that the State Board of Health is the proper channel through which action on these matters should be secured and I believe that we can get relief only when this board formulates certain sanitary regulations which are made compulsory on the corporations under consideration."

(12) "I believe much can be accomplished by state boards of health to render travel safer and more comfortable without entailing a financial hardship on the companies operating railway and street car lines, if approached, as I am certain they will be by your board, in a spirit of fairness to all concerned."

(16) "I am more than glad that you have taken steps along this line as I am convinced that much good can come from such action."

(20) "On general principles I think the State Board of Health should undertake to improve all existing conditions that can be bettered from a sanitary point of view."

(23) "I am glad to learn that you are about to take up the matter of car sanitation. Our street cars are far better than those of many other cities, but it would seem that there is still chance for much improvement."

(24) "I certainly think that it is a matter for the State Board of Health to consider and regulate so far as possible. Such moderate regulations to commence with as will not be too drastic will undoubtedly pave the way for a valuable change in the sanitary conditions of cars in the future."

(26) "I congratulate your board and wish it success in its efforts to bring about the desired changes in car sanitation."

(27) "It is very pleasing to me to learn that your State Board of Health is taking steps toward improving the sanitary condition of vehicles for the transportation of people."

(32) "I cannot see any better party upon which to put the duty of investigating and correcting these matters than the State Board of Health."

(33) "It would be a great protection to the public in general for every state to require its health authorities to inspect at regular intervals all cars for the transportation of people and report upon their sanitary condition. I hope that in a short time all the states will require this inspection."

(35) "If a State Board of Health has the power to enforce sanitary regulations I think it would be well for it to undertake the regulation of car sanitation."

(36) "I am pleased to learn that your Board is moving in the matter of car sanitation."

(37) "There is an urgent need for regulations along these lines in our own state, and I presume the same conditions obtain in all of the states."

(43) "Constant agitation of this question is necessary to keep us up to the mark."

(44) "It seems to me that the State Board of Health should interest itself in securing better sanitary conditions in cars of all roads."

(45) "I believe if State Boards of Health united and after due study of both the practical and scientific aspects of the subject recommended and adopted certain regulations, these might be of great value to the traveling public. Such recommendations or orders should be general for the whole country to be successful. All cars can and should be kept clean in every particular. Fresh and clean air in proper quantity can and should be supplied and properly distributed. The temperature of the car can and should be kept at a reasonably safe degree. The present over-crowding in our street and elevated cars is humiliating and dangerous. Intelligent, properly instructed and obedient help will become an absolute necessity in securing and maintaining these wholesome conditions."

ON CAR SANITATION IN MEXICO.

By DR. JUAN BRENA, ZACATECAS, MEXICO.

A problem which has not been yet satisfactorily solved is the ventilation of the railroad cars. The indefinable and complex odor of the paintings, varnishes and tapestry, increased by the mephitism of the passengers, the smoke of tobacco, of coal, etc., is well perceivable and hurtful to the health. In the alternative to breathe that confined atmosphere, or to replace it by thick clouds of tobacco and dust and of small particles of burning coal on opening the windows, there is no election in accordance with comfort and cleanliness. It seems, at first sight, that as the car is provided in all its length with movable glasses nothing would be easier than to graduate the quantity of the external air necessary to prevent the corruption of the air inclosed in the same car; but, besides the above said inconvenience, consisting in the entrance of smoke and dust, there are others which make that system of ventilation undesirable. Though it were reasonable to suppose that all the travelers are in equally good health, we must recognize that there are in them great diversity of organic fragility, of resistance to disease, of nervous susceptibility, etc.

If for some it be agreeable to travel having the window wide open, there are, perhaps, others to whom that current of air may cause them a neuralgia, a quinsy, or an affection of more consequence. When the train is *en route* many, without experiencing any trouble, pass from one car to the other, whilst in some other cases this practice has been the cause of serious diseases. All who have traveled have suffered the rude interruption of our sleep, of our thoughts, or of our reading, by the opening of a window that has projected violent blasts of cold wind over us.

The honorable governor of one of our states suffered some years ago, of a pneumonia, which nearly put him on the brink of death; and he assures me that it was just in one of such transitions when he experienced the painful feeling that announces the attack of a sickness.

It may happen, on the contrary, that some one, near a window, fearful of the dust, keeps it closed to the grievance of some others, who by the anguish of sea-sickness, of over-crowding, or of heat, suffer the tortures of imperfect breathing and the thirst for pure air.

It is to be regretted that up-to-date there has not been discovered

among the great variety of means with which modern mechanics supply the engineers, a system of perfect and automatic renovation of the air. The apparatus now used on the several lines of railroads render benefits of some extent, but no great results have been yet obtained from them.

The *Lancet*, of London, in 1901, suggested the idea of employing for this purpose the modified oxygen, called ozone. Experiments proved that this gas, even though in small quantities, destroyed the odor of the smoke of tobacco and others no less displeasing, with the same efficacy and rapidity with which it refreshes the air and destroys its impurities. Unfortunately, the use of this valuable disinfectant has been impracticable, owing to the enormous cost of its preparation.

In this question, the same as in others of similar character, the hygienist physician urgently needs the intelligent help of the public.

Only when the knowledge of personal behavior necessary to the preservation of one's own and the other's health is generally extended, will the correct use be made of the means somewhat primitive and simple with which cars are actually ventilated. It might be advisable, for the present, that the companies should order that instructions be placed in a visible part of each car, so as to impress on the mind of passengers how much they are interested in obtaining respirable atmosphere by the proper use of the windows, and at the same time the damages they may suffer from other passengers by their improper use.

The arrangement of the seats also deserves our attention. They are commonly situated one opposite the other, and each one with capacity for two persons, who consequently are placed in immediate contact, the more intimate the more corpulent they are. We have nothing to add so as to understand how anti-hygienic such arrangement is. Enough has been said on the necessity of denying admittance into the railroad cars, or to relegate them to a special car persons affected with contagious diseases. But at the same time it has been acknowledged impossible to follow that healthy advice; for railway employes are not qualified to diagnosticate whether a case is or is not a contagious disease. The result is that in an excursion we are liable to have as a companion in the same seat a sick person, who might communicate his disease to us. The substitution for the common double seats of a system of chair cars would in part diminish that danger, for each seat is laterally separated from the contiguous and even in the antero-posterior situation, as the chairs are commonly placed one behind the other, the thickness of the back of the seat remains interposed between the passenger and his neighbor. I will add, by the way, that when the night is spent in one of these chair cars, so much used in this country, by midnight the por-

ter offers to the passengers, for a little reward, some pillows to rest the head upon the chair. These pillows, or at least the pillow-cases, must be disinfected and washed from time to time.

In the railroads in Mexico they clean the seats and the backs of same with a wet and dirty sponge. The cleanliness thus obtained is such that one little blow with the palm of the hand over the surface of the seats is sufficient to make a cloud of pestiferous dust come out of them. This result would be avoided either by the adoption of the vacuum method or by the employment of compressed air brushes, which are now used on several lines of railroads in this great republic.

It is unquestionable that in a railroad car not only the fellow-travelers but also the railway employes may be the vehicle of a contagious disease. I do not know that in Mexico have been adopted any preventive measures on this subject, but it would be desirable to establish the practice in use in England, where any person applying for a railway position must give assurance of perfect health by a scrupulous medical examination, which is again repeated from time to time when the company believes it to be necessary. This precaution is not only beneficial for the passengers but also serves as a preventive measure against the accidents which not rarely are caused by the errors of the men in the charge of making the signals. The integrity of the health in general, but specially of the visual apparatus, is a thing of great importance in employes of so large responsibility and must be the subject of skilful examinations. It is worth mentioning in this connection an accident reported by the *Lancet*, and which occurred in Wakefield, England, in the year 1892. A man, whose duty was to make the signals, who was apparently in good health, died suddenly in the fulfillment of his duties and this fact was only discovered when an inquiry was instituted, so as to ascertain the cause the signals were not seen. The paper properly adds that no provision will be sufficient to absolutely prevent the possibility of an accident. But neither this nor any other reflection must prevail upon the sanitary authorities to abstain from endeavoring in giving the proper security and comfort to the great number of persons who travel by the railroads.

SOME GENERAL CONSIDERATIONS ON THE PATHOLOGY OF SMALLPOX.

BY W. T. COUNCILMAN, M. D., BOSTON, MASS.

I shall endeavor to give in this paper the results of an investigation of smallpox which was undertaken by members of the Pathological Department of the Harvard Medical School. The work on the disease in man was carried out in this city during the epidemic of 1901 and 1902. The experimental work was carried out in the Philippine Islands. Funds for this purpose were provided by the liberality of three gentlemen in Boston and by the Rockefeller Institute in New York. The results of the investigation are incomplete. There are many questions still to be solved and the solution can only come from further clinical and experimental study of the disease. There are great difficulties in the way of the investigation of smallpox. The disease only comes at intervals. The patients are not treated in well-organized hospitals, where there are facilities for and the habit of the study of disease. The hospitals in which the disease is treated are, as a rule, used only at intervals and are unprovided with laboratories. The great stimulus to research, clinical teaching, has no place in them. The energies of the physicians in charge are entirely taken up in controlling the exigencies of an unusual situation. The very atmosphere of a smallpox hospital is unfavorable for the careful determination of the questions to be solved and for quiet investigation. The isolation of the disease is unfavorable, in that the valuable aid given by constant comparison with other diseases is lost. There is frequently an attempt to keep the presence of the disease below the surface and to have nothing done which may in any way call attention to it. In the epidemic of 1901 and 1902 the health authorities of the city gave us every facility for investigation which was possible. Autopsies were held in fifty-two cases, embracing all forms of the disease, and provision was made that members of the department could live in the hospital.

Difficulties also attend the experimental study of the disease. Such study cannot be carried out in a laboratory, where there would be the possibility of the infection extending from the laboratory. The laboratory animals, as the rabbits and guineapigs, are immune to the disease. The only animal, so far as known at present, which is susceptible to smallpox is the monkey. These are expensive, difficult to acquire, and

in this climate very susceptible to disease. The majority of monkeys obtained from animal dealers are infected with tuberculosis. It was on this account that the expedition was sent to the Philippine Islands, where animals for experimentation could be easily obtained, and where smallpox virus was available from the occasional cases of the disease among the natives. The study of the disease in Boston was carried out mainly by Drs. Magrath, Brinckerhoff and Tyzzer, assistants in the Department of Pathology; by Professor G. N. Calkins, of Columbia University, and myself. The study of the disease in the Philippines was carried out by Drs. Brinckerhoff and Tyzzer. A number of articles on the disease have already appeared in the *Journal of Medical Research*, in 1903 and 1904, and articles embracing the work of the Philippine expedition will shortly appear.

From the middle of the last century up to the present there have been three periods in which the disease has been studied, and in which important contributions to knowledge have been made. In 1873, by the work of Weigert and other German observers; in 1902, by the work of Guanieri and other Italian observers; and in 1903, in this country, by the work of Howard, in Cleveland; of Ewing and Park, in New York, and by the work in Boston.

If material taken from a smallpox lesion on man be inoculated on an epithelial surface of a calf, after a definite period of incubation, a lesion which anatomically closely resembles the parent lesion, the pock, is produced, and marked constitutional disturbances, the most prominent of which is fever, take place. The material from the place of inoculation transferred to an epithelial surface on another calf develops in the same way, and after a series of transfers from calf to calf may be returned to man, and it develops not the original disease, smallpox, but the incomparably milder disease, vaccinia. This is no longer in doubt. Many of the strains of vaccine virus now used have been originally derived from smallpox. Just how many transfers from smallpox are necessary before the original virus loses its power of producing the parent disease is not known. One of our experiments in this regard is interesting. The contents of a smallpox vesicle from a monkey was used to inoculate the cornea of a rabbit. After five successful transfers from animal to animal, a monkey was inoculated and not vaccinia but smallpox was produced. This disease, vaccinia, confers immunity not only against vaccinia, but against smallpox. The immunity, though not absolute, is stronger than is developed in the course of most of infectious diseases. It persists a variable time, the variability being due to the individual. All the evidence which we have regarding the immunity shows that it is due to a germicidal power which the blood-serum has

acquired by the disease enabling the serum to destroy the virus of both vaccinia and smallpox when brought in contact with it. The disease, vaccinia, differs from smallpox in three striking ways: 1. The period of incubation is shorter, being in man five days and in the calf three days. The incubation period of variola is twelve days. It is possible to give a partial explanation of this difference by the fact that a very much greater amount of virus is introduced in vaccinia and the means for absorption of the virus or its products are facilitated by the trauma of vaccination. We have no means of knowing the amount of smallpox virus necessary to produce the disease nor the facilities which the primary focus affords for systemic infection. 2. In vaccinia the general exanthem is absent. There may be a few vesicles around the point of inoculation, which may be explained by the supposition that at the time of inoculation a small amount of the virus entered the superficial lymphatics and was distributed around a small area. Such satellite vesicles are exceptional. They are not due to the distribution of virus after its development at the point of vaccination, for they develop simultaneously. 3. For the development of vaccinia it is necessary that the virus be placed in contact with a susceptible epithelial surface. Vaccinia may be transferred from individual to individual by accidental contact or by means of intermediate objects, but I know of no cases in which the infection has been carried by the air.

If material from a smallpox lesion be placed in contact with a susceptible epithelium of man, not previously immunized, or of the monkey there develops at the site of inoculation a lesion larger but having the general characteristics of the pock, with constitutional disturbances, and an exanthem less abundant but having all the other characteristics of the exanthem of variola vera. All that we know of variola inoculata in man has come down to us from the old literature. Inoculation of smallpox to confer immunity from the disease is now obsolete in civilized lands. Plehn mentions that it is still carried out among the natives in Central Africa. All that we know from the old literature is to the effect that the disease was incomparably milder than smallpox and was attended by a remarkably low mortality when skilfully carried out. One of the general rules for successful inoculation was that the virus should be introduced superficially, never directly, into the skin or subcutaneous tissue. Among the Chinese it was the habit to inoculate by placing smallpox crusts in the nostrils. So far as can be ascertained the period of incubation is eight days. There is no doubt that the practice of inoculating smallpox to confer immunity would have been extensively used and probably still used were it not for the fact that the individual with the mild disease, variola inoculata, is capable of transmitting to

others the true disease. There is not the fundamental difference which is found in vaccinia. There is not a qualitative difference in the virus of variola inoculata as compared with variola. It is capable of air transmission, and in this way produces variola. It was formerly the custom for the individual before inoculation to undergo a certain regime of food and medicine, which was supposed to have an influence in resisting the virus, enabling the milder disease to be produced. There is no reason to believe that this was the case. With our present vastly increased knowledge of disease and nutrition, it can hardly be held that any regime would make an individual more resistant to a particular disease. Smallpox epidemics have not shown that the robustness of an individual diminishes the chance of infection or the virulence of the disease. Variola inoculata only differs from variola vera in its milder course and shorter period of incubation. A disease in all respects comparable to variola inoculata in man save that the period of incubation is shorter, is produced in monkeys by inoculating them with smallpox virus.

When smallpox prevails epidemically, individuals not immune acquire the disease. The susceptibility of man to the disease is almost absolute. Before vaccination, when smallpox prevailed endemically, with occasional epidemic extensions every twelve or fifteen years, it had become almost a disease of childhood. Adults had acquired immunity, by having passed through the disease in childhood. There is great difference in the severity of the disease in different cases and in different epidemics. The virulence of the disease bears a definite relation to the intensity of the exanthem, which has made possible the classification into variola without exanthem, discrete variola and confluent variola. A tendency to hemorrhage in the lesions is indicative of severity, the acme of virulence being seen in the type purpura variolosa, which differs so much from ordinary forms that its nature has been in dispute. To what these different degrees of severity are due we do not know. In an epidemic the most severe cases can apparently take their origin from the mildest cases. In the recent epidemic of the disease in this country, the general type was mild, and in certain parts of the country the mildness of the type was phenomenal. I have had the opportunity of studying the eruption in certain of these very mild cases, and have found the same histologic changes with the same types of organisms as in the severe cases, but the organisms were much less numerous. The period of incubation in smallpox is twelve days, this being the main point of separation between variola vera and variola inoculata. Vaccinia, variola inoculata, and variola vera have three points in common: The production of a local lesion, which in all three has the same general type,

swelling of the lymph-nodes adjacent to the lesion and the production of immunity. Variola vera and variola inoculata differ from vaccinia, in that a virus capable of air transmission is produced in the two latter, and the local lesion is followed by an exanthem. Variola inoculata differs from variola vera in the milder course of the disease and in the shorter period of incubation.

The study of smallpox in the last epidemic has thrown some light on these various conditions. The histology of the vaccine process is best studied by inoculations made on the cornea, a method which was introduced by the Italian investigator, Guanieri. The tissue of the cornea is extremely simple; there are no blood-vessels to complicate the picture, the epithelial cells are large, few in number, and all changes taking place in them are readily studied. The lesion differs from vaccination of the skin in the absence of vesicle formation, easily explained by the anatomic structure of the cornea which does not permit of it. Owing to the absence of vessels, the vascular reaction takes place around the cornea only, and fluid exudation passes through the thin conjunctiva and through the periphery of the cornea before reaching the lesion. The vaccination is made by passing a lancet-shaped needle obliquely into the tissue, making a slight trauma, of which there is no macroscopic evidence in the absence of the specific infection. In a successful vaccination, a small elevated, slightly opaque spot appears in twenty-four hours. Microscopic study of the cornea after sixteen hours shows the presence of small bodies, round or irregular in shape, within the epithelial cells. They are extremely small and of fairly constant size, the round ones varying about one micron in diameter.

By the examination of numerous corneas at varying intervals of time, it has been made out that these bodies increase in size, and with this growth a differentiation of structure takes place in the previously homogeneous body. Small points staining differently appear, they become more numerous, and finally the body breaks up in a number of small forms, which are similar to the smallest bodies first observed. The small forms again enter the adjacent cells, and the development is repeated. After fifty hours the small, the developing, and the segmenting forms are found in the same section. Similar bodies having the same course of development have been found in the vaccine lesion of the skin, cornea, and mucous membrane of the calf, in the skin and mucous membrane of the monkey, and in the skin of man. Their appearance constitutes the sole anatomic criterion for determining the specific nature of the process. They are found in no other condition. They can be differentiated from other accidental inclusions in cells. They have a definite relation to the nucleus lying in a space in the cell adjacent to

this. They grow, showing differentiation of structure with growth, and finally segment, this resulting in the production of bodies similar to the small forms first found. Similar bodies having the same development are found when variola virus instead of vaccine is used for inoculating the rabbit's cornea. We have elsewhere given the reasons which have led us to regard these bodies as living organisms, and as forming the specific contagium of vaccine. It has not been possible to find, or at least to recognize, such bodies in the vaccine lymph, but this is probably due to technical difficulties in the examination.

We have seen that the virus of smallpox differs from the virus of vaccinia, (1) in producing in man and in monkeys, not vaccinia but smallpox; (2) in being capable of air transmission; that, when smallpox virus is used for inoculating the calf or rabbit, a process in all respects resembling vaccinia is produced. When used for inoculating a monkey, a process identical with the pock is produced. We are concerned not with the anatomic structure of the pock, but with the specific bodies which are found there. With the development of the pock there first appear, included within the cells adjacent to the nucleus, bodies of the same size, structure, and undergoing the same course of development as in vaccinia.

Their study is attended with more difficulty in the skin than in the cornea, owing to the greater complexity of the tissue. In addition to the bodies already described in vaccinia and following them, other bodies begin to appear, which undergo their development not in the protoplasm, but in the nuclei of the epithelial cells. The development of the nuclear body finally results in the formation of a structure comparable to a sporoblast, in which spore-like bodies from one-third micron to one micron in size are formed. These differ in size and structure from the products of segmentation of the vaccine organism. In the earliest lesions in smallpox only the bodies in the cytoplasm of the cells are found. In the later lesions both are present, the intranuclear forms then occupying the center and oldest part of the pock. We believe as the result of our studies that the organism which constitutes the virus of vaccinia and smallpox is the same; that in vaccinia it undergoes a definite cycle of development, resulting in a structure, the gemmule, arising from simple growth and segmentation; that in smallpox a further and more complicated cycle of development, in which probably sexual forms occur, is added to the vaccine cycle. It is only in man and in the monkey that the conditions are favorable to the development of the cycle which constitutes smallpox. The intranuclear parasites are just as characteristic for smallpox as are the cytoplasmic forms for vaccinia. They are found in both variola inocu-

lata and in variola vera. They are not found in any other process. There is no doubt that in various pathologic conditions certain changes may take place, both in the nucleus and cytoplasm of a cell, which may have a certain resemblance to some forms of the parasites. Every one who has had any experience in the study of unicellular organisms in tissues knows that it is often impossible to say whether a single object belongs to the host cells or is a parasite. Not only must form and size and structure of the single individuals be studied, but their relation to their surroundings and their stages of development must be borne in mind. We believe that the spores which arise from the multiplication of the intranuclear bodies constitute the contagion of smallpox, which is capable of air transmission. This introduced into a susceptible animal develops the typic disease, smallpox, both cycles of the organism taking place in the lesions. In the non-susceptible animal, such as the calf or rabbit, only the single, and probably asexual cycle is developed, constituting vaccine. Even though the organism only undergoes this simple development, the potentiality for a complete development may be retained for a time, as is shown by the experiment of Dr. Tyzzer, in which a smallpox virus from a case of variola inoculata of the monkey, after passing through five generations in the cornea of rabbits, was still capable of producing variola inoculata with an exanthem in the monkey.

The experimental study of smallpox in the monkey was undertaken with the view of the investigation of the relationship between vaccinia, variola inoculata, and variola, the ascertaining of the mode of infection in man, the mode of production of the exanthem and the possible relationship between the exanthem and immunity.

Monkeys are susceptible to variola inoculata. It has not been found possible to give them the human disease, the true variola. This, so far as we know, only appears in man and is produced by a mode of infection which we do not know, but there are strong grounds for the hypothesis that the place of primary infection is in the respiratory mucous membrane. Attempts were made to give monkeys variola by means which would have certainly proved successful in man. They were exposed to smallpox patients in the wards of the hospital, material which had been in contact with the patients was placed in their cages and non-infected monkeys kept in the same cage with infected, but no effect was produced. The common monkey of the Philippines is the *Macacus cynomologus* which had been proved to be susceptible to both vaccinia and variola inoculata. Thinking that the higher anthropoid apes would be more susceptible to the disease and might develop variola vera, the same experiments were carried out with orang-utans procured from

Java, and these proved no more susceptible than the common monkeys. There is some evidence from the literature that monkeys can acquire variola. Andrew Anderson, in his book on "Fevers," gives an excerpt from a letter which he received from a friend who was traveling in Central America. He says:

In the year 1841 I was in the Province of Verague in New Grenada to the north of the Isthmus of Panama and left the town St. Jago on the western coast for David in Chiriqui a town in the interior about 60 or 70 miles to the northeast and leeward of St. Jago. The smallpox was raging with great violence in St. Jago, but there was no appearance of it in David. A few days after my arrival there, taking my accustomed morning ride in the forest which teems with animal life, I was struck by observing one or two sick and apparently dying monkeys on the ground under the trees. The next morning I was struck by the same singular appearance and by thinking that I perceived several on the trees moping and moving about in a sickly manner. I consequently dismounted and carefully examined two which were on the ground—one dead and the other apparently dying; and after careful examination no doubt remained in my mind that they were suffering and had died from smallpox. They presented every evidence of the disease, the pustules were perfectly formed, and in one instance, that of the dying one, the animal was quite blind from the effects. A few days afterward (I think about four or five days) the first case of smallpox appeared among the inhabitants of David and in the course of a fortnight half the population was stricken.

In 1858 Dr. Furlong, taking part in a discussion upon diseases in animals, stated that he had received a letter from the wife of a prominent physician of the Island of Trinidad who mentioned that during epidemics of smallpox in that island the wild monkeys suffered from the disease. Both of the statements, it will be observed, concern the monkeys of America, and it is not impossible that they may be more susceptible to the disease, but at the same time it must be acknowledged that the evidence is very imperfect. In explanation of the non-susceptibility of the monkey to variola, we would have to assume either that there is a qualitative difference between the virus of variola inoculata and smallpox, or that the monkey has a relatively greater immunity which prevents an infection from the very small amount of virus which the air may convey to a susceptible surface or that there are anatomic or physiologic differences which may prevent the virus reaching such a surface. The only evidence for a qualitative difference in the virus is that the monkey is susceptible to one only, and that the disease produced differs in the monkey and in man from variola vera in its milder type and shorter period of incubation. Variola inoculata is the same in the monkey as in man, save that period of incubation is shorter. The

constitutional reaction takes place in man on the eighth day, and in the monkey on the sixth or eighth. In the monkey a well marked pock develops at the site of inoculation and reaches its acme on the eighth day. The exanthem begins on the eighth or ninth day. The extent of the exanthem varied greatly. In some animals only one typic lesion was present, while in others over a hundred were found. In the monkey, as in man, the distribution of the exanthem showed a partiality for certain regions. The face was most often the site of an eruption. Elsewhere in the order of frequency it was present upon the wrists, the scrotum of the male, the region about the anus and base of the tail, on the palms of the hands and the soles of the feet, or the inner aspect of the arms and thighs. The eruption seemed to avoid the trunk and the outer hairy surface of the limbs.

It seems possible that the shorter period of incubation of variola inoculata may be explained by the greater amount of virus which is used for inoculation, compared with the probably small amount in ordinary infection, the greater primary amount enabling the increase which is necessary to produce the constitutional disturbance and the exanthem to take place more quickly. But it must also be evident that if the period of incubation depended on the amount of virus primarily used, it would vary in duration with the amount of virus used. It is also possible, as Brinckerhoff and Tyzzer suggest, that the period of incubation may be short in variola inoculata in consequence of the virus being introduced into the circulation at the time of infection.

Attempts were also made to produce variola vera in the monkey by varying the place of inoculation. It is generally believed that in man a primary infection takes place on some mucous surface from which systemic infection follows. There is no anatomic evidence for this assumption. No one has ever found such a protopustule. In our 52 autopsies, careful search was made for such a lesion, but in vain. In variola vera there are no symptoms of such a lesion, but it is possible that a simple pock situated in the lungs, for instance, could pass through its development without giving rise to symptoms. We all know how extensive a tuberculous process can exist in the lungs without the production of symptoms. This set of experiments yielded interesting results and which are capable of explanation. Variola inoculata with exanthem and immunity follows primary inoculation of the skin. Immunity is not produced, or very rarely produced, by inoculation of the cornea, the mucous membrane of the nose, mouth, or palate. It is produced by inoculation of the trachea or by blowing the virus into the lungs without the production of a lesion. The study of the character

of the primary lesion in these places gives the explanation. The exanthem and the immunity are due to the absorption of products from the primary focus. In the case of the skin such products are retained by the impermeable horny layer, and absorption is facilitated. In the mucous membrane and in the cornea the absence of the horny layer causes an ulcer and not a vesicle or pustule to be produced, and the products escape on the surface. In the trachea and in the lungs, the thin layer of epithelium renders the absorption of the products easy, both from the lesion and from the mucous surface. But by none of these experiments was variola vera produced. It seems also probable that if a protopustule be developed in variola vera it must be in the lungs or in the larynx or trachea, because only in these places can the necessary absorption take place. The absence of symptoms would probably exclude the larynx and trachea.

Comparative study of the vaccine and variola virus was undertaken in the course of the Manila work. While the series of experiments was not sufficiently extensive to permit final conclusions as to the comparative resistance of the two viruses, they have shown that there is a difference, the vaccine virus being more resistant than the variola.

Variola virus dried on glass rods at room temperature was found inactive after two weeks, while the vaccine virus under such conditions was unchanged. The variola virus seemed to undergo an attenuation both after prolonged exposure to glycerin and after passing through a series of monkeys. The attenuated virus finally lost the power of producing an exanthem, though a typical local lesion was produced. It was not ascertained whether by the attenuated virus only, the vaccine cycle of the parasite was produced. Only one filtration experiment was made, and this showed that the virus of variola did not pass through the Berkefeld filter.

The study of immunity which was produced by the two viruses also gave interesting though at present inexplicable results. From the experiments it has been shown that the immunity produced by vaccine virus against both vaccinia and variola inoculata is stronger than the immunity produced by variola inoculata. Locus of the primary lesion had influence on the subsequent immunity. The most effective immunity was produced by variolations, or vaccination of the skin where the conditions best favor absorption. Vaccinia was also shown to have greater power for infection than variola. It was found possible to produce immunity for variola inoculata and not for vaccinia. There was a certain interesting local immunity produced. Even vaccination of the skin did not always produce perfect immunity toward the corneal infection. This tends to show that the immunity is due to the

action of the serum on the parasites, and that when the conditions are unfavorable for the serum to exert its action on the virus there may be infection in an animal otherwise immune.

The study of the histology of variola inoculata in the monkey, has also given interesting differences as regards variola. In variola in man, one of the most striking anatomic facts is the small part which leucocytes play in the lesions. In the early process in the skin, and before the lesions become infected, there may be no leucocytes present. The blood count shows a marked diminution in the neutrophile leucocytes. Examination of the blood-forming organs shows the same diminution in these leucocytes and an increase in the cells belonging to the lymphoid series. In our earlier work, it seemed probable that the diminution in the neutrophile leucocytes was due to the imperfect differentiation of young forms. In variola inoculata, this striking leucocyte reaction was absent. Numbers of leucocytes were present in the local lesions and an active leucocyte formation in the blood-forming organs.

We feel that in our work on smallpox, which is nearing its temporary conclusion, the fundamental questions relating to the disease have not been answered. These questions are: 1. The parasite and its complete life cycle. We feel confident of the hypothesis of the vaccinia and variola cycle which we have brought forward, but it remains for the present a hypothesis. 2. The relationship between vaccinia, variola inoculata and variola vera. Our work has served to accentuate the differences between these conditions. We cannot advance even a tenable hypothesis with regard to the internal relationship of variola inoculata and variola vera. The difference in the period of incubation in the two diseases, the non-susceptibility of the monkey to variola vera and the absence of the leucocyte reaction in variola inoculata, is striking. 3. The mode of infection in variola vera. Our work suggests a primary infection by air-borne virus and in the lungs. The only evidence is that the lungs are susceptible to a primary infection by means of insufflated virus. But this in the monkeys produced variola inoculata and not variola vera. 4. The mode of production of the exanthem. The specific lesions of smallpox are only developed on epithelial surfaces. The Manila work has shown that the specific lesions in the testicle are associated with the presence of the organism. It is assumed, and there is good ground for believing, that after an increase of contagium at a primary focus the organisms enter the blood and are carried as emboli to the skin, where they produce the eruption. But this is again a hypothesis. We have found that the organisms in variola inoculata pass from the primary lesion into the endothelial cells of the blood vessels and enter the blood. We have not proved

at what stage of the disease the blood is infectious nor how long. 5. The immunity, its mode of production, and the relationship between the natural and acquired immunity.

The answers to these questions involve long and arduous work by skilled investigators on both the human and the experimental diseases in monkeys. For the work a constant supply of variola virus and experimental animals is necessary. We believe that the work can only be carried out in places where both these conditions can be fulfilled. It is probably true that we shall always have smallpox with us. Notwithstanding the fact that we have in vaccination a mode of defense which leaves little to be desired, there will always be opposition, more or less effective, from people who are utterly incapable of appreciating the value of evidence. These people furnish the material for small epidemics which give opportunities for investigation. Investigation in smallpox is costly. It demands the entire time of well-trained investigators, who are to be found associated with universities, and the compensation for such men should equal that of a competent clerk. The investigations carried out by the Harvard Medical School have been brought to a temporary close by the lack of further funds and by the necessity of rounding up present work. Smallpox is a disease which has been of the most influence on the human race, it is the only one of the exanthems which is open to animal experimentation, and with the full solution of the questions which it brings up, it is not too much to hope that light may be shed on the allied diseases.

THE PATHOLOGY AND ETIOLOGY OF HUMAN VACCINIA.

BY WILLIAM TRAVIS HOWARD, JR., M. D.

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The results of the studies made during the last three years in Boston and Cleveland on variola, and of those of Tyzzer in Boston on vaccinia of the calf and rabbit have rendered it important that vaccinia in man should be carefully studied in the same manner.

Last fall, in association with Dr. Perkins, and through the kindness and interest of several assistants and students, I had the opportunity of making the observations which form the basis of this paper.

Material and Methods. — Thirty men were vaccinated in the usual way on their left arms in three places, at the same time. Twelve men showed successful vaccinations, and from these twenty-three pieces of skin were excised, at various periods from 48 to 168 hours after vaccination. In each case one vaccination area was left undisturbed for observation and for immunity. As further controls, skin was taken for study from three unsuccessful vaccinations. The skin was fixed in Zenker's fluid, in paraffin, and sections were stained by a variety of methods, eosine and methylene blue, and Borrel's stain giving the best results. In no case were there complications or other untoward results.

Pathology. — In general, it may be said that the skin lesions of vaccinia closely resemble those of variola, but are more rapid and severe, owing probably to the presence of a larger amount of virus present in a given area as well as to the manner by which the virus reaches the skin.

Contrary to the common belief and teaching, the formation of the vesicle and the destruction of the epidermis are almost complete in forty-eight hours after vaccination. At this period, the earliest at which this material was excised, the sections show usually a single vesicle, composed of a reticular mesh-work of coarser and finer strands of hyaline fibrinoid material, which is formed from degenerated epithelial cells. The meshes or spaces of the reticulum contain fluid and finely granular material, with but few cells. The lesion is cup-shaped, and not fan-shaped like the variolous lesions.

The earliest changes of the epidermis consist of swelling and reticular degeneration of the epithelial cells. Many cells are completely

hyaline, while others show larger and smaller *hyaline* droplets. The invasion of one epithelial cell by another, as is seen so commonly in vaccinia of the rabbit's cornea, is often seen. Nuclear degeneration is conspicuous, and takes several forms:

1. Swelling, with increased prominence of the reticulum.
2. Massing of the chromatin in the center and along the nuclear rim; and
3. Wrinkling and retraction of the nuclear rim.

Later changes comprise condensation and shrivelling of the nucleus, followed by nuclear fragmentation and the dispersion of particles of nuclear dust in the cytoplasm and intercellular spaces. All the above described changes are to be seen at the lateral margins, and at the base of the lesions. At the base from one to three or four rows of epithelial cells in various stages of degeneration are to be seen. Comparatively few blood-cells have invaded the forty-eight-hour lesion. The changes in the corium are intense. They consist of oedema, hemorrhage and leucocytic infiltration of the tissue, with swelling and proliferation of the endothelium of the blood and lymph vessels. These changes are much more marked than in the corresponding stage of variola. They are responsible for the marked inflammatory characters of the vaccine lesion. As will be seen, they persist for a long time, even after healing is well under way.

In the seventy and seventy-two-hour lesion, all the epithelial cells below the horny layer have disappeared or are necrotic. The spaces of the reticulum are smoother and the strands are coarser. In the middle and deeper parts of the vesicle fibrin and leucocytes are prominent. The leucocytes are of the large and small mononuclear and eosinophile types. On each side of the original vesicle there are early secondary vesicles, analogous to those present at the margins of the advancing variola vesicle. In these the process repeats itself, and a good opportunity is afforded for studying the earliest changes in the epithelium, which are found to be identical with those occurring at the beginning of the forty-eight hour lesion.

The oedema and cellular infiltration and endothelial cell proliferation are more intense than in the forty-eight hour lesion. From seventy-two hours on, the chief changes are (1) condensation of the reticulum into a dense hyaline material containing broken down leucocytes, (2) further necrosis of the epithelial cells at the margin of the lesion, (3) persistence of the oedema and vascular changes in the corium, (4) regeneration of the epidermis and the throwing off of the crust or scab.

In the ninety-six hour lesion the reticulum of the original vesicle is

quite dense, and the secondary vesicles present the same appearances noted in the forty-eight hour lesion. Apparently no third crop of vesicles forms.

In sections of skin excised 120 hours after vaccination the reticulum and exudate form a dense homogeneous mass of deeply-staining hyaline material, containing necrotic leucocytes. This mass forms the scab or crust. The flattened epidermis projects under its margins in a slanting line. The bottom of the lesion is distinctly narrowed. The cells of the projecting epidermis show numerous mitotic figures. The inflammatory changes in the corium are still active.

The 168 hour, or seventh-day lesion, presents the same characteristics as the last, but the projection of the epidermis beneath the scab is still more marked. The inflammatory changes in the corium are still in evidence. The scab or crust is evidently separated from the underlying exposed corium when the renewal of the epidermis is complete. This must take some time.

ETIOLOGY OF VACCINIA.

In the several hundred sections studied, no bacteria were found. There was complete absence of any evidence of pyogenic cocci. Structures corresponding to the primary cytoplasmic stage of *Cytoryctes variolae* as described by Councilman, Magrath and Brinckerhoff, Calkins, and Howard and Perkins in the early stages of variola, and by Tyzzer in vaccination of the calf and rabbit, were found. These bodies were found in only the forty-eight hour and seventy-two hour lesions. There was complete absence of the secondary cytoplasmic and the intranuclear stages of *Cytoryctes variolae*. Hence our observations on this point are in complete agreement with those of Tyzzer on vaccinia in the calf and rabbit.

INTERPRETATION OF THE LESIONS OF THE HUMAN SKIN IN VACCINIA.

The process is very rapid, vesiculation being almost complete in forty-eight hours after vaccination. The current belief, based upon clinical observations, that vesiculation begins on the fourth day is erroneous, for at this time the degenerative changes in the epidermis are at an end, the vesicle filled with leucocytes, the reticulum condensed, scab formation has begun, and the lesion is a well established pustule. Within forty-eight hours after inoculation upon the surface of the skin most of the epithelial cells of the affected area are destroyed and the corium shows well-marked inflammatory changes. The changes in the skin in vaccinia and in variola are very much the same, but those

of the former are much more intense. This is probably to be explained by the greater number of organisms introduced at vaccination, and by the larger areas of skin affected. There are various differences in the course of the two diseases. In variola, the vascular changes precede those of the epidermis, while the opposite obtains in vaccinia.

In variola, in which the infectious agent reaches the skin by means of the blood-vessels, the epithelial changes spread outwards, in vaccinia downward toward the papillae. This difference in the manner in which the virus reaches the skin accounts for the cup-shaped lesion of vaccinia and the fan-shaped lesion of variola. The degenerative changes in the epithelium and the manner of reticulum and vesicle formation are identical in the two lesions. In both, these degenerations occur in cells which contain parasites and in those which do not. In both there is evidence that the degenerative and inflammatory changes are due to the action of one or more soluble toxins, which act in many ways like the diphtheria toxin. It would appear also that the process of immunity production is intimately associated with the setting free of this poison in the lesion, for the oedema and other inflammatory changes persist long after the process in the epidermis has ceased to extend.

In view of the foregoing, we venture to offer the following hypothetical suggestions to explain the lesions of vaccinia. The organisms introduced into the epidermis invade the epithelial cells between the horny and malpighian layers. The invaded cells undergo various degenerations leading to necrosis and reticulum formation under the influence of the parasites which they harbor. With the segmentation of the first crop of parasites and the escape from the infected cells of the resulting gemmules, a soluble toxin is discharged into the lesion. Some of the gemmules invade neighboring cells (autoinfection) and secondary vesicles are produced. The toxin causes the widespread degenerations, especially the hyaline and the hyaline fibrinoid changes leading to necrosis, as well as the proliferative activities of the epithelium, according to the concentration in which it reaches the affected cells. The rapidity and extent of the lesions of the epidermis are thus explained. The toxin exerts also a powerful and prolonged effect upon the blood and lymph vessels, resulting in congestion, oedema, and cellular exudation and proliferation. With the formation of the secondary vesicles, local immunity is apparently established, for a second local autoinfection rarely occurs. Reparative processes in the epidermis are well established in the 120-hour lesion. It would appear that the asexual cycle (primary cytoplasmic stage) of *Cytoryctes variolae* is completed ordinarily in less than forty-eight hours. The process of

immunity production probably continues for several days after the formation of the vesicle.

CONCLUSIONS.

1. In human vaccinia vesiculation is well established by the end of the second day.

2. The changes in the epidermis correspond closely to those of variola, but are more severe and rapidly destructive of epithelium. The changes in the corium are much more intense and persistent in vaccinia than in variola.

3. As was to be expected from the work of Tyzzer on vaccinia in the calf and rabbit, the primary cytoplasmic and not the secondary cytoplasmic and the intranuclear stage of *Cytoryctes variolae* occurs in human vaccinia. This and the intensity of lesion (owing probably to the greater number of organisms introduced in vaccination) mark the main differences between variola and vaccinia.

4. Granted that the groups of cytoplasmic and intranuclear bodies described by Councilman and his co-workers, by Calkins, and by Howard and Perkins in the skin lesions of variola and vaccinia are parasites causing these diseases, it seems that certain lower animals have the property of inhibiting the development of the sexual cycle, but permit that of the asexual cycle, which is pathogenic for both man and these animals and gives rise to an immunity in man which protects against both cycles.

FURTHER EXPERIMENTS WITH VACCINE VIRUS.

By DR. W. F. ELGIN, GLENOLDEN, PA.

DATING OF COMMERCIAL VACCINE.

At a meeting of this Association at Havana in January of this year, I read a paper taking up and discussing briefly each of several problems presenting themselves more or less urgently for solution to those engaged in the preparation of vaccine virus. Among other questions of importance which were noted at that time, was the one relating to the life of vaccine; or in other words, the length of time which might elapse between its collection and use. It was further noted that this largely depended on the surrounding temperature and a table was given covering a period between January and October, 1904. An inspection of this table showed January vaccine to remain active ninety-eight days; while that collected in September showed an assured activity of only twenty-five days. Tests were continued from November 1st, 1904, to June of the present year. The following results were noted:

Month.	No. Vaccines.	Ave. Temperature R. T.	Ave. Temperature I. C.	Ave. period of ac- tivity R. T.	Ave. period of ac- tivity I. C.	Ave. time to date of expiration.
November	11	20°C	9°C	106 days..	108 days..	79 days
December	18	15°C	9°C	108 " ..	123 " ..	72 "
January	8	15°C	7°C	104 " ..	119 " ..	91 "
February	19	20°C	9°C	103 " ..	130 " ..	96 "
March	13	22°C	9°C	79 " ..	109 " ..	97 "
April	8	22°C	9°C	78 " ..	84 " ..	74 "
May	11	23°C	9°C	56 " ..	59 " ..	68 "

In this table we have given the average life of vaccine at both room and ice chest temperature. It will be noted that the average room temperature rises as we approach the summer and that the life of the virus is correspondingly shortened. It is further shown that glycerinated vaccine properly prepared and stored at a temperature below 20° C. deteriorates slowly; but as the surrounding temperature rises above this point rapid degeneration of vaccine becomes pronounced.

The practical application of these facts was dwelt upon in the paper previously mentioned and attention is called to them here to emphasize the importance of doing the routine vaccinating in the winter or spring as is the German custom rather than in August and September to prepare for entrance to the public schools.

VACCINE IN COLD STORAGE.

In the former paper to which I have referred, were given some results obtained by placing vaccine in cold storage at a temperature of -13°C . to -15°C . The experiment then detailed has been continued during the past eight months and additional data gathered.

The virus after remaining in cold storage at a temperature approximating -15°C . from two months to a year or longer, was taken out and divided into two parts; one part placed at room, the other at ice chest temperature (11°C .). Tests were made from time to time until a deterioration was noted in either of the two forms. From data thus obtained the following table was constructed:

Month of Collection.	No. Vaccines.	Ave. time in Cold Storage.	Ave. period of activity R. T.	Temperature.	Ave. period of activity I. C.	Temperature.	Time of removal from Cold Storage.
Jan., '04..	8	9 months	50 days..	15°C	138 days.	7°C	July to February.
Feb.	4	9 months	42 days..	20°C	84 days.	9°C	July, '04, to February, '05.
March ...	1	5 months	21 days..	22°C	231 days.	9°C	August, '04.
April	6	6 months	35 days..	22°C	119 days.	9°C	August, '04, to March, '05.
May	6	7 months	49 days..	23°C	91 days.	9°C	August, '04, to March, '05.

An examination of the above table reveals several facts:

First. That virus exposed to a low temperature approximately will remain active for a considerable time without deterioration.

Second. That after removal it will remain active very nearly if not quite as long as ordinary virus treated in a similar way.

Third. That when removed in the summer months and exposed to room temperature, it rapidly deteriorates. This confirms observations noted with ordinary virus as reported in the previous table.

Further work is being done along these lines, and if it should confirm

our present results, it will enable vaccine laboratories to close up during the hot months and draw virus from cold storage; it having been made and placed there under more favorable conditions than is possible during the summer.

COMPARISON OF BULK VACCINE AND SINGLE VACCINATIONS STORED UNDER SIMILAR CONDITIONS.

In this connection, it was suggested that perhaps tests made on vaccine in bulk would not apply to small quantities, as a single vaccination.

In order to determine this question, virus taken in February and March, was put up in single vaccinations and as a control some of the same virus in bulk. These after remaining in cold storage for three months were removed and part put at room and part at ice chest temperature. Tests were made at intervals and from data obtained, we have the following table:

Month of Collection.	No. Vaccine.	Time in C. S.	Ave. activity tube R. T.	Ave. activity point R. T.	Ave activity bulk R. T.	Ave activity bulk I. C.
February	5	3 months	36 days..	32 days..	36 days..	42 days
March	3	3 months	36 days..	28 days..	36 days..	42 days

The ice chest tests were not completed when the laboratory closed for the summer, so that vaccines kept at ice chest temperature were good until June 30th, and further tests will be necessary to determine how long they will remain active. Sufficient has been learned, however, to indicate that virus will remain active practically as long in capillary tubes as in bulk; but it will be seen that glycerinated points deteriorate sooner than either; this is borne out by other experiments, which appear to indicate that the glycerinated point will not remain active so long as the same vaccine in capillary tubes, nor is the character of the vesicle quite as good as the virus gets old. Why this is so we have not been able to determine.

COMPARISON OF NORMAL VACCINE WITH THAT TAKEN FROM THE DEEPER SKIN LAYERS.

In my Havana paper under the head of "Forms of Vaccine," attention was called to a deep layer or the material from the base of the vesicles after the removal of the ordinary tissue. The conclusion reached was that this layer which had been previously lost was apparently as rich in vaccinal material as that normally used; and at the same time freer from bacteria.

Since that time, a large quantity of this virus has been removed and subjected to the same conditions as normal virus. From tests completed to this time, we have the following table:

Month.	No. vaccines.	Kind.	Ave. period of activity R. T.	Ave. period of activity I. C.	Temperature R. T.	Temperature I. C.
February	6	Deep....	106 days	133 days	20°C	9°C
February	10	Normal..	115 days	134 days	20°C	9°C
March	4	Deep....	70 days	115 days	22°C	9°C
March	7	Normal..	92 days	114 days	22°C	9°C

From this is noted that at room temperature, the normal layer lasts a few days longer than the deep, while at ice chest temperature it has practically the same life. The difference in either case, however, is too slight to prevent the use of the deeper layer. Experiments are still continuing and should a still larger volume of evidence show similar results, it is hoped that the quantity of vaccine obtained from a given animal will be materially increased.

TOLOUL.

Early in the present year Dr. Kinyoun called my attention to an article in the January number of *Rivista D'igiene E Sanita Publica*, by Dr. Carini of Tavel's laboratory of Berne, in which he entered into a discussion of a method devised for the purification of vaccine virus by means of toloul. This method suggested itself to him because of the successful employment of toloul by the various European laboratories for the protection of serum and toxin from contamination.

His method consisted in thoroughly mixing a given quantity of pulp with toloul in the proportion of 10 to 2 and allowing it to stand for four

days; when it was noted that the bacteria has been practically all destroyed. The virus was then mixed with glycerin in the usual manner.

At Dr. Kinyoun's suggestion, on March 16th to a given quantity of fresh vaccine pulp was added an equal quantity of water. To 10 c. c. of this water emulsion was added 12 c. c. of water and 4 c. c. of toloul. making solution No. 1.

To 10 c. c. of the watery emulsion was added 12 c. c. glycerin and 4 c. c. toloul, making solution No. 2.

Glycerinated lymph was prepared as usual for a control. Both of the forms containing toloul were thoroughly mixed by being agitated for two hours.

All of these forms were tested for bacteria on the 20th of March; per .01 c. c. of No. 1 gave 9 colonies; No. 2, 20 colonies; and control 3010. Twenty-four hours later No. 1 was found to be free; No. 2. gave 6 colonies.

Tests for activity on animals were made of both forms up to June 22, when deterioration was noted in both; No. 1 being reported as poor, while No. 2 gave a good medium take. This was 98 days after mixing.

On April 5th, vaccine was removed from calf No. 880 and treated as before mentioned. Solution No. 1 with water; No. 2 with glycerin. Both were agitated for two hours. On April 6th, these were centrifuged for 5 hours, when it was noted that the material was separated into three distinct layers: the lower being heavy animal tissue, apparently skin cells and elastic tissue; middle layer, liquid; and the top a soapy emulsion which appeared to be a saponification of toloul with the fats. No free oil was apparent which it was hoped could be drawn off from the top layer. It was then determined to attempt the removal of the oil by bubbling a current of sterile air through the mixture in a specially constructed U tube. The air mixing with the toloul gave a combustible mixture which burned at the point of exit with a Bunsen flame. When the air at the exit was no longer sufficiently rich in toloul to be combustible the blast was continued for one-half hour longer, when it was thought all the free toloul had been expelled. The material was then placed at ice chest and room temperature for subsequent tests.

On April 10th, .01 c. c. of each form of the emulsion was found to be free of bacteria, while the control contained too many to count. The last test was made on June 22nd, when both forms gave extra good results. This was 78 days after treatment.

These experiments were repeated from time to time during March, April, and May, occasionally with slight variation, but practically always with the same results. The material treated with toloul, whether the latter is removed or not, appear to be active almost if not quite as long

as the control, while the non-sporeforming germ life was destroyed in from 4 to 6 days.

As previously reported, a number of experiments with other chemicals, carbolic acid, chloroform, etc., had been made and, while encouraging results were obtained, yet we never felt sufficiently sure of vaccine cleared up through these agencies to use it in ordinary routine distribution.

The experiments with the toloul, while too few to be of more than relative value, are nevertheless strongly confirmative of Carini's report; and should further tests show similar results, it is believed that by use of this method we may be able to quickly destroy the non-sporeforming germ-life found in vaccine without materially interfering with the activity of the product.

CONCLUSION.

It will be noted in the foregoing report that experimental work during the past nine months has been directed as previously, to the solving of two important problems of vaccine production, *Purity* and *Potency*. It has been shown that, however much it may be desired, it is a practical impossibility to cover both of these points in virus for routine distribution.

Vaccine which has been rendered aseptic by any known means of purification is frequently worthless when it reaches the hands of the consumer; while virus guaranteed to be potent with any degree of certainty after a reasonable time, must and does contain the various staphylococci and occasionally streptococci, when it leaves the laboratory.

Criticism on this point from eminent bacteriologists and public health officials have at times been severe. We frequently hear the suggestion that states and cities manufacture their own vaccine and thus insure its purity; and attention is constantly directed to Germany as an illustration of what can be accomplished in the way of protecting the people against smallpox; and yet in these laboratories where the vaccine is made under official direction of the government, bacteriological control has been entirely abandoned. I have visited three of the principal establishments — Berlin, Cologne, and Dresden — and found no routine bacteriological examination attempted.

As quoted in a previous article, Frosch claims in his official report that the bacteria contained in the virus does not increase the inflammatory condition in the person vaccinated, and he gives a series of experiments confirming this view.

Calmette of Lille made practically the same statement.

Dr. Park of the New York laboratory, which I believe has been in

existence longer than any other public laboratory in this country, expressed a similar view at the last meeting of this Association.

I do not agree with the German authorities that bacteriological control should be abandoned, but I do think we have a right to expect the authorities who demand purity and potency in the same virus to show us some practical means of accomplishing this and not expend all their ammunition in theorizing on one phase of a dual proposition. Is government control the cure? Then, government control has existed for two years, and we still have no rules laid down for our guidance other than cleanliness, and care in the preparation of this important product.

No reflection is intended upon the officers of the Public Health and Marine Hospital Service, who have this matter in charge, as we feel that they are giving us all the help possible under the circumstances and we appreciate it; but what I mean to say is, that knowledge upon these subjects is not sufficiently definite and accurate to admit of government regulation.

If it is believed that cities and states should make their own virus, then let this Association through a report from a committee after investigating this subject so state; though I fail to see how the fact that the material is produced in a public laboratory rather than a private one, will bring about a remedy, in view of the fact that the laboratories having the longest experience and greatest success in handling this subject have abandoned this position regarding bacteriological control.

However, the object of this series of papers is to arouse some interest on the part of the members of this Association in this very important question in hope that something may be accomplished more tangible and lasting in its nature than mere fault-finding without suggesting a remedy.

PRESERVATION AND METHOD OF ADMINISTERING HUMANIZED VACCINE IN MEXICO.

BY DR. FRANCISCO BERNALDEZ, MEXICO CITY, MEXICO.

In previous papers, which I have had the honor to read before this Public Health Association, on the value and advantages of humanized vaccine, which is the kind that has always been administered in Mexico, I have demonstrated, by means of long experience and observation, that the dangers which are attributed to it are not true, always provided that the necessary precautions are taken, in the application of the prophylactic.

A fact, which has already been established by the above mentioned papers, is that humanized vaccine confers immunity which lasts for the entire life of the vaccinated person. I do not now want to allow this point, which has been thoroughly established by a great number of observations, to pass unperceived, even though it is not the principal object of this brief paper. During the present year, and up to this date, eight hundred and twenty-five persons of over eighteen years of age have been revaccinated. Amongst these 532 had been originally vaccinated with human lymph, and in no case, did the re-vaccination take, though, in some cases, a false vaccine developed at the point of the inoculation. Of the balance of the persons re-vaccinated, who were 293, and most of them foreigners, who had originally been vaccinated with animal lymph, it took with 97 persons, of whom the undersigned had any knowledge, as of the others there were no reports as the parties did not appear again. From these numbers we can safely infer the efficiency of human vaccine as compared with calf lymph, which only grants immunity for a short period.

Humanized vaccine is utilized, either directly from arm to arm, or else by being collected and preserved in the proper tubes. In order to make this collection, it is necessary to take certain preliminary precautions. First of all it is necessary to select the child who is to furnish the lymph as it is necessary that he should be entirely healthy and beyond suspicion of suffering from any transmissible disease. In order to obtain this object, it is necessary to know the health antecedents of the parents, of the brothers and sisters, if he has any, and especially all the details of the child which has the pustules; that he should be over three years of age, so as to have got beyond that at which hereditary syphilis

could show itself. By taking a child at this age and by following the course of the vaccination in his person, we can tell that he has not shown the symptoms of that disease and can safely declare that he is free from syphilis.

Once we have selected the child, we have to inspect the pustules in order to know their real character and that they are caused by and proceed from real vaccine. In order that we may more easily perceive the difference between the false and the real vaccine, we recommend that the inoculation should be made by means of separate punctures and not as in many countries by extensive scarifications, in which it is impossible to recognize the evidences of true vaccine. As the vaccination has been administered by separate punctures, which give rise to separate pustules, it is noted that the eruption does not make its appearance until the third or fourth day under the form of a very small papula, which, during the following days is transformed into a projecting button, which is well pronounced and level. Between the fifth and sixth day the pustule has grown still more and has been transformed into a species of flattened vesicle, with a depression in the centre, of an opaque pink, and with the periphery of a pale blue and tortoise shell color. The edge of the vesicle projects outward and above the rest of the skin. At this time we also observe a limited inflamed red zone. All of these symptoms become more pronounced during the following day until the eighth day from the inoculation when the pustule is ripe and bears all the characteristics of one; that is to say, that its edges are round and raised, the surface flat with a granulated aspect, the color white streaked with tortoise shell, slightly bluish reflection, less opaque on the edges. The central depression has grown and assumed a slightly darker color than the rest of the pustules, around which is an inflamed red circle of greater or lesser diameter, according to the individual. The pustule which does not present these characteristics must be considered as unfit for transmission or for collection of the lymph which may ooze out.

In order to transmit the vaccine from arm to arm as well as for the purposes of collection, the pustules are simply washed with sterilized water and never with antiseptic liquids, which would diminish or destroy the activity of the lymph. Once the asepsis has been practiced in this manner, the pustule is repeatedly lanced, because, as will be remembered the true vaccine pustule is formed of a great number of small cavities or cells, and, in order to get the whole or the greater part of the lymph to run, it is necessary to puncture the pustule in different parts. In practicing this operation, it is necessary to take great care to allow no flow of blood, because, according to certain observers,

the blood is the vehicle for the transmission of infectious diseases, should the child from whom the lymph is being taken, unfortunately have any, whilst on the other hand, if the lymph is mixed with blood it cannot be preserved. Immediately after having scarified the pustule, it begins to discharge, the lymph collecting in small drops, and this is the right moment for taking it up with the lancet and practicing the inoculations, or filling the tubes.

In order to fill the tubes, it is only necessary to put one of the ends over the drop of lymph, in order to get it filled by capillary attraction. The tubes, properly are capillary at the two ends, because in the center they are widened in the form of an ampula. Before being utilized in the collection of vaccine lymph, the tubes are sterilized in the autoclave and, in this manner, the lymph can be preserved for periods that have exceeded two years, always provided that they are hermetically sealed at the ends, by means of a blow pipe. The purity of the lymph which is thus collected, has been proved by putting some tubes, which have served for the experiment, in a stove, with a temperature of 37° for a period of a month, and kept at that temperature, which is favorable to the development of colonies of microbes. The lymph contained in those tubes has maintained itself clean and transparent, without losing any of its force.

In order to extract the lymph from the capillary tube, we proceed as follows:

The two ends are broken and through one of these we pass a capillary tube made of rubber till it reaches the wider part, in order that the fit may be perfect. In the other end of the rubber tube, there is a glass mouthpiece with a cotton stopper and through this we blow to dislodge the lymph from the tube which is collected in a watch glass, in order afterwards to dip the point of the lance and so make the inoculations. As a general thing, the amount of lymph contained in one of these capillary tubes is sufficient to vaccinate from eight to ten persons.

It is well understood that the number of capillary tubes, which can be filled from each pustule, is variable, but generally speaking we may say that it is from five to eight.

From the above it will be seen, that with this method of procedure for the preservation of the vaccine, there is no necessity of making use of glycerine, which is indispensable for the preservation of calf lymph, which, as some authors have already shown, greatly diminishes its activity or power to grant immunity after a very short while. This may perhaps be one of the reasons why the immunity conferred by animal vaccine is of such short duration.

THE RESTRICTION OF CONTAGIOUS DISEASES IN CITIES.

BY DR. CHARLES V. CHAPIN, PROVIDENCE, R. I.

Modern municipal sanitation may be divided into two periods. The first occupied the middle half of the nineteenth century and was dominated by the filth theory. The second extended from 1880 to the present time and its procedures were influenced by knowledge of the parasitic and transmissible nature of the infectious diseases. There was some truth in the old theory, and the facts of parasitism and contagiousness are incontrovertible. But the deductions from the facts were not entirely warranted. The watchword of the earlier period was municipal cleanliness, of the second period isolation. We are now entering on a third period in which our practice will not be based on wide generalizations. We shall study with greater care the mode of transmission of each disease, and shall strive to devise appropriate measures for each.

Municipal cleansing did much to diminish typhoid fever and cholera, and the isolation of the sick has doubtless had a similar effect upon smallpox, diphtheria and scarlet fever. But as it can be shown that much municipal cleansing was unnecessary and ineffectual from a sanitary standpoint, so I believe it can be shown that isolation and accompanying procedures are often ineffective and unnecessarily severe. In all this work we must remember that the measures taken are justified only by success. It is to diminish disease that the health department exists, not to enforce law. The constraint of the citizen during contagious disease is not for punishment but for the prevention of infection.

Isolation and disinfection, which for the last twenty-five years have been the chief weapons for fighting the contagious diseases, were based upon the supposition that practically all infected persons could be reached, and controlled during the period of infection. The experience of the last few years indicates that this assumption is entirely unwarranted. At the last meeting of this Association I attempted to show that the unrecognized sources of infection, either well persons or those slightly sick, were often as numerous, or more numerous, than the recognized cases. The year past has furnished additional proof of this, and health officers show by their writings, that they

are coming to realize more and more the enormous importance of unrecognized cases in the extension of the contagious diseases. This new and important fact, that unrecognized sources of infection are the chief factor in the spread of disease, has not thus far modified to any great extent restrictive measures, but it must necessarily do so in the future. While it is true that modern science has rendered less burdensome isolation and disinfection in typhoid fever, cholera, plague, and particularly yellow fever, yet for the more common contagious diseases that we have constantly present in most of the cities of the United States, as measles, scarlet fever and diphtheria, these measures have during the last twenty-five years been applied with increasing strictness. It may be admitted for purposes of discussion, that of late years there has in this country and England been a decided decrease in the mortality from scarlet fever, diphtheria, and probably a considerable decrease in the incidence of these two diseases. It is probable also that the decrease has been due in part at least, to the public health measures referred to. But admitting this, it does not at all follow that the same ends might not have been attained by simpler measures, and neither does it follow that it is desirable to increase the stringency of these measures, or that by so doing there is any reasonable hope that these diseases will be eradicated, as is so often promised.

It will doubtless be admitted that the success of isolation in restricting the infectious diseases will depend upon the completeness with which all the sources of infection can be controlled. If all the foci of infection are controlled, the disease will be eradicated. If only a small proportion of the centres are known, probably no effect will be produced. If say one half the sources of infection are controlled, perhaps some appreciable effect will be produced on the prevalence of the disease, and perhaps not. In such diseases as influenza and pneumonia there is reason to believe that the number of persons bearing the specific organisms is much greater than the number reckoned as sick. Yet restrictive measures in these diseases have been seriously urged. There is no reason to believe that their attempted enforcement would result in any diminution of these diseases. Cerebro-spinal-meningitis is another disease the specific cause of which is, so far as our knowledge goes, wide spread. Yet official isolation in this disease has been proposed and practiced in a number of our cities, though there is not the slightest ground for thinking that the disease is in any way thereby diminished. In contrast with these diseases is smallpox. In no disease is the diagnosis so easy or is such a large proportion of cases likely to come to the notice of the health officer.

If isolation and disinfection ever accomplish anything it must be in this disease. There is reason to believe that much has been accomplished and that numberless outbreaks of this disease have been checked by the labors of the health officials. But it must be remembered that in this disease we have in vaccination a powerful auxiliary to isolation, and that too much credit must not be given to the latter. It seems to me extremely doubtful if a widespread outbreak of smallpox in a large city could ever be checked by isolation and disinfection without recourse to vaccination. Indeed Bracken claims that this is never possible, and his contention that isolation in this disease should be abandoned so that the public may be brought to realize the necessity for vaccination, has much to recommend it. It is scarcely possible for us in the present state of public opinion to maintain such a position, and it is probable that for many years to come isolation will prove a necessary and useful measure in this disease.

Between such a disease as influenza where official isolation is of no avail, and smallpox where under present conditions it is often effective, are a number of diseases concerning which there is room for, and need of, free discussion. First of all it must be recognized that there are only two logical methods of dealing with these diseases. One is to do nothing officially, which is neither desirable nor practicable, and the other is to diligently seek for all infected persons and secure their isolation as long as infection remains. From what we know of the prevalence and duration of infection in well persons, it is evident that the latter is impossible. Only a middle course is possible, and this of necessity must be irrational, a compromise, and unsatisfactory.

Typhoid fever is a disease which is often transferred quite directly from one person to another. Recent civil practice, as well as the experience of the Spanish and South African wars, indicate that this is a much more common source of the disease than was formerly supposed. It has therefore been urged that isolation should be enforced in this disease somewhat as it is in diphtheria or scarlet fever, and some cities have resorted to placarding the house for this purpose. But it is not likely that anything would be gained. Rather would erroneous ideas be thus inculcated, and unnecessary fear excited. Better far is it to rely on teaching that strict personal cleanliness by means of which the management of this disease can be conducted with reasonable safety.

Measles has received comparatively little attention from health officers, though, at the present time, it is as important a cause of death as scarlet fever. Because so few cases are seen by physicians, and because the disease is infectious for several days before it is likely

to be recognized, health officials have felt that there was little use in stringent measures of isolation. Children sick with measles are kept out of school for two or three weeks, and usually other children in the family are also excluded, though sometimes and preferably, this applies only to those who have not had the disease. The closure of the lower school grades, particularly kindergartens, whenever five to ten per cent. of the children are infected, is sometimes done, and would appear to be a wise procedure. Placarding is occasionally resorted to, but whether it is a wise measure or not is an open question. As so few cases are seen by a physician it is to be feared that the placarding of houses would result in a widespread concealment of cases. As a matter of fact there is no evidence that restrictive measures thus far adopted have had any appreciable effect in checking this disease, and it is difficult to believe that more stringent measures would be more effectual.

Whooping cough presents an even more unfavorable public health aspect than measles. As a cause of death it is about on a par with measles. Like measles it does not seem to have been at all affected by public health measures. It is true that restrictive measures have not been energetically enforced in this disease, and owing to the fact that the diagnosis is difficult, that in many cases no physician is called, that the infection remains a long time and we have no means of determining how long, it is very unlikely that any restrictive measures, however energetically applied, would accomplish much in diminishing this disease. The exclusion of the sick from school, the occasional closure of schools, and perhaps placarding, seem to be the only available measures.

In most American cities scarlet fever and diphtheria receive more official attention than all the other infectious diseases together. This is because until recently, they have been much more important as causes of death than have the other common diseases, and even now diphtheria is a serious disease. The mortality from both these diseases is very much less than it was, and this is usually attributed entirely to the restrictive measures adopted against them. That it is partly so due is probable, but I mistrust that it is not entirely brought about in the manner usually assumed.

To consider scarlet fever first, it is becoming evident that we can not eradicate this disease from our cities. At present the question of the value of hospital isolation in this disease is exercising our English friends. In many English cities for the last ten or fifteen years, a large proportion of the recognized cases of this disease, even as high as eighty or ninety per cent. have been removed to the hospital.

Yet the disease is about as prevalent as ever in those cities, and not less than it is in cities without hospital facilities. So too the cities in this country with large hospital facilities do not appear to have less scarlet fever than those with no hospitals, and cities which maintain isolation in the most stringent manner are no freer from the disease than are those where lax measures prevail.

In those English cities where from eighty to ninety per cent. of the cases are in the hospital, and the others are in well to do families where they are well isolated at home, the incidence of the disease continues year after year, not very different from what it was before hospitals were established. Everything points to the conclusion that the disease spreads not from the recognized cases, which are well isolated, but from the unrecognized sources of infection. The remedy then is not to render more burdensome the control of the recognized cases, but rather to make it lighter, so that there will be less temptation to concealment, and what is far more important, to devise means for lessening the danger from the unrecognized sources of infection, a difficult matter which few have attempted.

For the management of this disease at the present time the writer would suggest that the patient be separated from the public. In the majority of cases this can be done in the home. The easiest way to accomplish this is by a warning sign on the house. This not only keeps the patient in, and the public out, but it teaches that the disease is contagious. I believe that a considerable part of the decrease of this disease is due to the very general recognition of its contagious nature, and the warning sign has been an important factor in this education. Hospital facilities should be provided for those who cannot have decent care and isolation at home.

The most difficult problem is to determine the duration of isolation. Four weeks is perhaps a good limit. It may be that three weeks would do as well. I fully realize that some cases remain infectious for many weeks or months, but we have no means of determining the duration of infection. The desquamation is no indication; in fact there is reason for thinking that the exfoliated epithelium is not infectious at all. Discharges from mucous surfaces are a better indication but are not reliable. But the chief reason for not maintaining a prolonged isolation is that it is unreasonable and ineffectual, though of course individual cases will arise when it is advisable. It is probably necessary at present to exclude from school all the children of the family. Wage earners should rarely be interfered with. Instead of keeping them out of work I not infrequently intercede with employers to take their help back. As for official disinfection, which

often is merely a fumigation which does not disinfect, it had better be omitted entirely. People contract scarlet fever from chance contact with persons not known to be infected. We can never teach them this, and teach them to guard against it, so long as by fumigation we encourage the notion that it is infected things that do the harm.

When the antitoxin of diphtheria was discovered it was expected that the disease would rarely cause death, and when methods were devised for readily recognizing the diphtheria bacillus, it was thought that we would soon be able to exterminate the disease. Ten years have elapsed, but diphtheria is still the most serious of our common infectious diseases. Notwithstanding that the diagnosis, and the determination of the duration of infection are more certain than in any other disease, the application of the most stringent measures of isolation and disinfection, based on the most thorough bacteriological examinations, do not appear to have been much if any more effectual, than the very loose and uncertain methods practiced ten or fifteen years ago. We have been steadily strengthening our restrictive measures, but with little avail. We were justified in doing this so long as we were justified in the hope that it was possible to control all or nearly all the sources of infection. We now know that this is impossible. The clinical and epidemiological history of this disease, as of scarlet fever, indicates that it spreads almost exclusively from unrecognized sources. In scarlet fever we have only the clinical method of inferring the prevalence of unrecognized foci of infection, but in diphtheria we have also direct bacteriological evidence that infected well persons, and slight sore throats, are far more numerous than recognized cases of the disease. Under these conditions the most stringent methods of isolation can never accomplish more than very moderate restriction. This is the teaching of experience. The history of the outbreak at the Willard State Asylum for the Insane in New York is most instructive in this connection. This outbreak was most ably managed and well reported by members of this Association. In a community of nearly three thousand persons every one sick or well was isolated until three successive negative cultures were obtained from nose and throat. Disinfection was thorough. Yet the outbreak lasted about four years. Such measures are of course impracticable in municipal outbreaks. If such thorough procedures are not feasible, and would rarely be successful if they were feasible, why not admit the limitations of enforced isolation, and reduce our requirements to a minimum? Reasonable procedures for the present might be to placard all reported cases, keeping up isolation on a

time limit of say four weeks, to exclude all children from school, to permit most wage earners to go to work, to provide hospital accommodations for the very poor, to furnish free antitoxin and free bacteriological examinations. Official disinfection may well be abandoned. Unless at least two negative cultures are obtained from every member of the family, and this is an impossible requirement, disinfection is a farce, and in any event there is little necessity for it, and its practice gives rise to false ideas as to the mode of extension of the disease, teaching that it is things, not persons that are to be feared.

The specific suggestions herein made for the restriction of our common contagious diseases are by no means intended as final. The only thing insisted on is that at present the tendency of sanitary practice in relation to these diseases should be reversed. Instead of constantly endeavoring to render isolation more complete the effort should be made to reduce the restrictions to the lowest limit compatible with the object sought. This object is not the extermination of these diseases, for such an end is impossible of attainment. The object to be aimed at is not the absolute, but merely the approximate prevention of extension from the recognized cases, and most of the danger from recognized foci of infection can be prevented by moderate measures.

I was asked to write about restrictive measures in cities, and it is to be remembered that what has been said applies only to cities. In small communities which have been free from the disease, the appearance of one or a few cases demands entirely different treatment. Under such conditions the most stringent measures are called for, and will often be successful in checking the outbreak. So too when a rare disease like plague, appears even in the largest city, stringent measures are needed. It is only when the virus of a disease has become widely distributed that the common methods of management become ineffectual and therefore unnecessary.

QUARANTINE. THE DELIRIUM FEROX OF AMERICAN SANITATION.

By JOHN S. FULTON, M. D., BALTIMORE, MD.

At the proximal end of the scale of insanity, the alienists recognize a delirious mania which occurs, without warning, to persons in good physical condition, though it may mark the onset of an acute disease. It is asthenic madness, of hopeful prognosis usually, but very sharp while it lasts; without systematized hallucinations or delusions, but characterized, above other insanities, by incessant vigilance, noise and movement. Our forefathers, who saw this type of mental disturbance in the early stages of smallpox and other acute fevers, called it *delirium ferox*.

In the last few months we have heard much criticism of the "quarantine madness" in the Gulf States, and indeed the newspaper accounts of quarantine excel in interest the news about yellow fever, the exciting cause of quarantine. But there have been no new vagaries in recent quarantine. The appearance of yellow fever in the South, and especially at New Orleans, has invariably engendered panic, and subjected stricken communities to hostilities as furious as those of 1905. Every Southern health officer, indeed every Southerner, knows that instant quarantine is the penalty of yellow fever, and, in the matter of diagnosis, nothing short of certainty will justify the admission by a Southern health officer that yellow fever exists within his jurisdiction. Prompt notification of the occurrence of yellow fever is not expected of Southern health officials. It is nothing new for the presence of yellow fever in New Orleans to be first published after a visit by the health officials of Mississippi. Alabama officials, on occasion, do the same courtesy for Mississippi, and Louisiana officials for Texas. Downright lying about yellow fever (if it be not) might be among the resources of some Southern health officials without grievous offense to normal consciences. It is beyond me to admire a virtuous act which devotes one's own people to a sacrifice so bootless and inhuman as that which inevitably falls upon a community invaded by yellow fever. Such quarantine as we have recently witnessed is essentially brutal, being actuated only by the instinct of self-preservation. One cannot see in it the spirit of helpfulness; it is without pity—an incoherent, raging, fierce delirium—more destructive than the disease against

which it is aimed. The South is not the exclusive habitat, nor is yellow fever the only excitant of this form of anarchy. The history of smallpox in the United States during the past seven years furnishes examples of quarantine madness, and in the history of cholera and plague there are many incidents showing that maniacal self-defense is not peculiar to certain times and peoples. Quarantine has always been incoherent; it arose when the idea of contagion first become rooted in the popular mind, and has never been saner than might consist with popular ignorance concerning the causes of disease. Its excesses have been the logical penalty of that ignorance, and to foster that ignorance was the grievous sin of medical men for centuries.

If American quarantine were free from its panic-bred extravagances, it would still lack much of conformity with medical common sense and business principles. While their viciousness needs no proof, the occurrence of insane quarantines in recent practice demands some consideration, as a serious phase of social disorder. When we are told that the sanitary authorities protested against these irrational procedures, but that the functions of sanitary administration were violently usurped by the people, or by other departments of local government, I am at loss to distinguish such a state of affairs from revolution. Such disturbances have occurred in towns and counties in Georgia, Alabama, Mississippi, Louisiana, Arkansas, Tennessee and Kentucky. Boards of health have experienced violent discord in Georgia, Alabama, and Mississippi; and the throes of revolution in Arkansas. Wherever such things occur they signify that the sanitary arm of government is too weak to be relied upon. It makes little difference that some of these boards went down, not under the weight of official tasks, but before epidemic lawlessness. A real board of health is an integral part of governmental machinery, and able to maintain its integrity against any odds which the local government can withstand. In unfavorable political environment, in professional unfitness for the work of public hygiene, in popular ignorance and official apathy, one sees but the minor causes of failure in sanitary operations. Mend all those conditions and the stability of sanitary government would not be assured. The chaotic spectacle of public sanitation in the South at this moment is, I am convinced, not incidental and does not justify any sweeping criticism of Southern officials. The prevailing conception of sanitary government is essentially weak, and it is not at the South only that sanitary defenses break down in emergencies. In a majority of the United States, even in most American cities, boards of health are organized for no constant utility, but for emergency use only. The Board of Health of Louisiana is organized to resist yellow fever. It possesses a

large and expensive quarantine equipment, but has no hand-to-hand engagement with any sanitary problem of any sort in the absence of yellow fever. At the beginning of the present yellow fever epidemic the State Board of Health of Mississippi was heard of for the first time in some years. Here, too, yellow fever alone sets the sanitary branch of state government in motion. The State Board of Health of Alabama is not so easily forgotten, for the Alabama State Medical Society is the State Board of Health. But the State Board of Health of Alabama, except when yellow fever is present or impending, does not concern itself with any of the interesting and important hygienic needs of Alabama. In Texas there is no State Board of Health. All the sanitary authority is vested in a State quarantine officer, and the recent panic has caused but little internal discord in Texas, because the state, as a whole, is committed to medieval quarantine methods.

I daresay that the people have received from nearly all these boards as good service as can reasonably be expected. Without data concerning the people, without regular exercise in the hygienic tasks which these states offer, how can the officials either know or be known by the people of Alabama, Mississippi, Louisiana or Texas? What else can they possibly hope to bring to rare emergencies, except stout hearts and willing bodies? Skill is no fairy gift, nor attainable otherwise than by use. Men who fail in such situations may be delinquents but it is fairer to regard them as victims. When these four states recognize the supreme importance of ever-present and familiar causes of death, when health officers can sharpen their wits in seeking out and relieving common needs of the people, there will be an end of delirious quarantine. Meantime, governors and mayors will now and then assume to know as much about public hygiene as do the hygienists, and occasionally so much may be assumed without inordinate conceit.

Considering those quarantine measures which most Southern health officers approve, we find the utmost disorder in their operation. Hundreds of independent local quarantines spring up on every hand, and very often they spring up not on information but on suspicion. Small towns, lacking the means of securing reliable information, and often in disregard of authoritative advisers, become *incommunicado* toward the round world and all that is therein. No one knows how many independent quarantines there are in any of the four states most concerned. It is impossible to know, for the scene is kaleidoscopic. A traveler cannot ascertain upon what conditions he may go about his business. Even health officers sometimes fall into each other's man-traps.

There are, however, examples of yellow fever quarantine which pro-

ceed in orderly fashion, and represent the hygienic tactics soberly approved by good officials. These tactics include restrictions upon the traffic of common carriers, transfer of passengers and freight to fresh cars at the borders of infected territory, with disinfection and return of the emptied cars; official surveillance of through passenger trains, by armed guards usually; certification of passengers in the matters of possible exposure, physical condition, point of departure, route and destination; state border defense by armed men at bridges, ferries, fords, railway stations, public and private roads, and steamer landings; arrest and detention of travelers unable to prove non-exposure.

Contrasting the meager dimensions of an ordinary sanitary organization with the requirements of such a programme as this, the expansion is stupendous. The men and means necessary to repel yellow fever in this way would go far to prepare a state for actual war. The fact that people willingly incur such enormous expense and endure such hardships invests yellow fever with horrors difficult, impossible perhaps, for the inexperienced to imagine. It is not to be expected that those who confront such possibilities will promptly abandon long-established defenses in favor of cheaper ones, highly recommended, but new. Until four years ago preventive medicine had no attractive proposition to offer in the prophylaxis of yellow fever. Without the intervention of yellow fever itself, a sound conversion of public opinion on this subject probably could not have been effected in so short a time. The truth concerning the agency of mosquitoes in the spread of yellow fever is now permanently impressed on the thinking people of the South, and to those who knew the status of popular and professional opinion a year or two ago the present status of that opinion is most encouraging. It is but natural that this new truth should have been utilized at first as supplementary to customary procedures, and not as profoundly modifying or abrogating them. But the Southern people have now a chance to criticise their former methods, and it is most gratifying to note that dissatisfaction with quarantine methods is now strong enough to prevail in the South. The recent failures of inland quarantine have not been more conspicuous than those of former times, but in former times prophylaxis meant quarantine or nothing, while to-day it is possible to apply a constructive criticism to the prophylaxis of yellow fever.

Inland quarantine has always failed, and just in proportion as quarantine has been more stringent its failure has been more complete. The unmistakable signal that yellow fever has appeared is not in the statements of local officials, nor in the opinions of visiting officials. It is in the movements of the people. Exodus from New Orleans always

begins before the quarantine bars fall, and this exodus occurs not so much because yellow fever is present as because the rigors of quarantine are impending. In the recent epidemic the people were advised by an extraordinary flurry in the stock exchange, and the exodus began at once, anticipating quarantine by about ten days. Quarantine is intended to stop this exodus, but probably has the opposite effect of increasing the number of refugees. The more stringent the attempted restrictions, the more is quarantine resolved into a game of wits between the officials and the people, and in this game all the odds are against the officials.

If the people of New Orleans had been convinced at the beginning of the present epidemic that no general quarantine would be declared, a majority of those who left the city would probably have remained at home. If the regulations concerning travel had required nothing more than a certification of no known exposure and a notification of the authorities at the point of destination, there would have been less panic in New Orleans, and practically no concealment or evasion on the part of refugees. Such a regulation would have intensified the existing panic in non-infected towns, but the added fear would have been wholly unreasonable, for every town where the truth about yellow fever is believed can afford to take the chances involved in travel under these simple regulations. With the destruction of mosquitoes in railway cars, with notification of outside health authorities concerning passengers en route, and with proper medical certification of non-exposure at the point of departure, railway quarantine would hardly be recognized as quarantine at all, but would nevertheless meet every requirement of public convenience and safety.

The prevailing methods of certification of passengers are far from satisfactory. No health officer can write a certificate with a comfortable assurance that it will prove acceptable to the end of a journey. Whenever public officials are agreed upon the proper form and contents of such a certificate it will include a reasonable identification of the passenger, the proposed route, the destination (including address), and the number of the train; it will allege some satisfactory means of ascertaining the fact of non-exposure, will be issued by a responsible official, without fee, and will be delivered by the passenger to the health authorities at the destination point. Offices for this business should be established at the railway stations in infected towns, and telegraphic reports should convey to outside health officials information concerning passengers to be expected, in advance if possible, of the arrival of their trains.

A rational plan of defense, prepared before hand on some such

lines as these, would reduce to insignificant proportions, or perhaps abolish forever, the detention camp, cordon militaire and other costly features of border quarantine, and would concentrate the more intense activities on and immediately round the infected areas. This brings up two objections. The first is that operations for the defense of outlying territory cannot and ought not to be conducted by local authorities. For the sake of avoiding the extreme penalties of quarantine, a great commercial city, as New Orleans, might consent to carry such a load, but fairness and sound policy forbid that such a responsibility, or any part of it, should rest upon an infected city.

The other objection is that such a plan would require pre-arrangements, entered into by all local authorities having interests at stake, whereby the responsibility could be equitably distributed and freedom of action might be assured to officials operating outside their ordinary political bounds. That such pre-arrangements are impossible is obvious. The equities of a joint campaign could not be determined beforehand, and could not be adjusted afterward. No sort of unity is possible under any general terms of agreement, for in these matters the unit of local government cannot be defined — at least not in terms familiar to American politicians. Rational, uniform and effective inland quarantine can only be had in the United States through the medium of the Federal government. A powerful arm of the Federal government is already authorized to render these services, and I know no field of practical work in which the Bureau of Public Health can earn greater distinction than in demonstration of the definite and orderly procedures by which the spread of yellow fever can be closely limited without seriously increasing the burdens of an infected locality.

I count it somewhat unfortunate for the United States Public Health Service and for the State of Louisiana that the conduct of the New Orleans campaign was turned over to the Federal officers.

Satisfactory as their work has been, I do not believe that the government officials have handled the New Orleans situation much better than was possible to the local authorities. What Louisiana expected to gain by the transfer was not a better local fight, but better credit with her neighbors and less rigorous quarantine. The profit may justify the deed, but the precedent is a bad one. It would have been much better for all concerned if the health authorities of Alabama, Mississippi, Louisiana and Texas had requested the United States Public Health Service to set up effective barriers between them and the city of New Orleans. In that case the Federal officers would by this time have established intimate and confident relations with local health officials throughout the infectible territory, rendering services

which the general government can properly offer, and local governments can properly ask, without offense to local pride or self love. As matters stand, the energies of the Service are wholly absorbed in searching out and extinguishing local foci, services which the general government should not expect to render save under conditions of acute and general necessity, and which local governments will not request except as a *dernier ressort*.

In our insular and territorial possessions, where states are in the making, the general government may very properly undertake the control of epidemic situations. But the dignity of statehood implies self-sufficiency against the emergencies which a state may reasonably anticipate, and I am convinced that it is as bad for a state as for a man if it be easier to find a substitute than a remedy for weakness.

Circumstances have determined that the United States Public Health Service should attempt but one, and that the lesser one, of two first rate chances to bring the country into its debt. From this time on the defenses against yellow fever will not be weakened by popular or professional unbelief as to the essential cause of yellow fever. It would be difficult to overpraise the unassailable demonstration which has been made in the epidemic now expiring, but I cannot help regretting that the United States Public Health Service had not a chance, at the same time, to suppress for ever the delirium of inland quarantine.

In recent years the control of maritime quarantine has been gradually passing into the hands of the United States Treasury Department. Within a year the quarantine stations of four Atlantic States have been transferred, and it is quite evident that American States and cities will invest no more in this business. If the history of maritime quarantine could be obliterated, and the subject could be discussed as new business, a proposition to leave the matter in the hands of seaboard states would receive scant consideration. The seaboard states would resist such a proposition and would be sure of a good majority of the inland states in favor of government control. Important ports of entry have always seen the equity of this question and have often succeeded in pushing the responsibility of maritime quarantine back to the state government, or, failing in this, have equipped and operated their own quarantines. Local governments, thus obliged to carry responsibilities properly belonging to the general government, have avoided expense by levying direct taxes on foreign trade, and thus it happens that maritime quarantine, by producing its own revenues, is not recognized as an unfair burden upon the locality. While local authorities do not wish to be rid of them, some of these quarantines may continue indefinitely under local administration, but the best of them are not serving the country

as they should, and eventually they will have to recognize certain outside obligations, or else make way for the proper performance of these services by the general government. Fortunately the occasions are rather rare when inland interests in maritime quarantine become very acute. In 1892 and 1893 American boards of health realized very deeply their interest in seaboard quarantine against cholera. The port of New York was at that time a center of very embarrassing solicitude, and the quarantine service at New York did not satisfy the legitimate demands of the situation. A great many health officers have remained steadfast in the conviction that local maritime quarantines probably cannot, and certainly do not, in defending their local interests, meet the reasonable needs of the country.

In November a conference of the governors of Southern states will review the whole subject of quarantine. Recent newspaper comments suggest rather drastic reforms. In this matter, I, for one, have little fear that considerations of public convenience and commercial freedom will cut too deep into prevailing methods. Every amelioration which is likely to be demanded in the matter of quarantine can be secured, and preventive medicine should be called on to justify this profession. The business of the coming quarantine conference, difficult enough no doubt in execution, may be very briefly stated. It is to ascertain the price of modern sanitary administration, and to buy enough of it to extinguish the more expensive features of quarantine.

MODIFICATION OF PRESENT PORT INSPECTION.

By DR. A. H. DOTY,

HEALTH OFFICER OF THE PORT OF NEW YORK.

It has been evident for some time that the methods of inspection, which are frequently employed at coast quarantine stations cannot be depended upon to detect the presence of mild or ambulant cases of infectious disease, which so far as the public health is concerned constitute one of the most dangerous factors with which we have to deal. This is due largely to the fact that visual examinations are frequently trusted to determine the physical condition of passengers and crews arriving on incoming vessels. Besides, too much reliance is placed upon the expiration of the maximum period of incubation of these diseases in the release of persons arriving at quarantine from infected ports experience has shown that the accepted maximum period of incubation of some of the infectious diseases has in numerous instances been exceeded, and also that the invasion may be very mild and unrecognized. Furthermore, the early symptoms are sometimes obscured by deliberate efforts on the part of the person affected; also infectious diseases not uncommonly appear in a "masked" or irregular form. The frequency with which these occur is not fully appreciated. For illustration, it is stated on reliable authority that a case of cholera recently found in Hamburg was admitted to the hospital as pneumonia. If we had to deal simply with typical cases, I am quite sure that infectious diseases would rarely enter seaport towns from incoming vessels. A full appreciation of this will satisfactorily explain the origin of many outbreaks of infectious disease, the source of which is unknown. The fact that mild and irregular cases are frequently overlooked has more than anything else given strength to the theory that cargoes, baggage, etc., often transmit disease, which is not the fact. As a result of the latter, commerce and the traveling public have long suffered from unnecessary detention and expense. A mild case of infectious disease under the inadequate method of inspection to which I have referred may pass unrecognized. The person thus affected may enter a seaport, transmit the disease and inasmuch as the original case was not recognized, it is reported the infection was transmitted by cargoes, clothing, baggage, etc. In a number of instances in my own experience careful investigation has conclusively shown

that outbreaks of infectious disease, the cause of which was at first unknown was due to mild and ambulant cases. During the present year six cases of yellow fever have been removed from incoming vessels at the Port of New York to the Swineburne Island Hospital. The vessels from which these cases were transferred were six days or more in transit from an infected port which exceed the period of incubation of this disease. Two of the cases were well marked on the arrival of the vessels, the remainder, however, or two-thirds of the entire number passed the visual examination, stated that they were well and apparently were so, but when their temperatures were taken an abnormal condition was disclosed. One of these cases could have passed unrecognized throughout the entire disease inasmuch as it was very mild. The fact that these cases were all infected at the port of embarkation and not on shipboard was conclusively proven by the patients, who after removal to the hospital admitted that they had been sick two or three days before the arrival of the vessel.

It has been frequently stated by writers, that the beginning of the school season marks an increase in the number of infectious diseases, particularly diphtheria, scarlet fever and measles, and it is believed that this is due to the transmission of disease by the clothing of children, who come from homes where infectious diseases exist. A number of years ago, the health department of the City of New York, established a "school corps" composed of medical inspectors for the purpose of making a daily examination of the children in the public schools. The result of this investigation has conclusively proven that these diseases are transmitted in schools principally by the presence of mild or unrecognized and convalescent cases and not by infected clothing. I am quite sure that while all public health officials believe that the clothing of those suffering from infectious diseases may act as a medium of infection, the majority of these officials, who have had long practical experience are satisfied that the clothing worn by well persons is a medium of infection only in rare instances. As we become familiar with the facts to which I have referred, we more fully understand that as a rule persons and not things transmit disease and that the interference with the cargoes of vessels, baggage, etc., unless there is some specific reason for it is unnecessary and unjust.

The use of the clinical thermometer constitutes one of the most valuable aids in detecting the presence of mild or unrecognized cases of infectious disease. This instrument has been employed at the New York Quarantine Station for the past five or six years, and I am fully satisfied that in this way many cases of the above character have been detected. When I refer to the use of the thermometer, I mean its

employment combined with every possible safeguard to insure a true temperature register. If it is used carelessly or poor instruments are employed because they are cheap, etc., this means of detecting disease becomes a farce and worse than useless. Only the very best thermometers which can be procured in the market should be employed, and every care should be taken to insure the correct temperature of the persons under observation. While a number of thermometers may be used, every one whose temperature is being taken should be kept under constant and close observation. Except in some special instance, a person should not be allowed to take their own temperature or use their own instrument, and the quarantine officer should satisfy himself that the persons under observation have not resorted to means to prevent the proper register of their temperature, such as the use of ice, ice-water, etc., which is not uncommonly resorted to.

During 1902, a series of investigations were made at the New York Quarantine Station to ascertain the normal temperature of the body and the result of the investigation was published in the *Medical Record* of November 1st, 1902. In this investigation 16,152 temperatures were taken with carefully registered thermometers and every means was employed to secure correct temperatures with the following result:

582 were between.....	96	and 97.	F.
1124 were between.....	97	and 98.	F.
2108 were		98.	F.
779 were		98.2	F.
7340 were between.....	98.4	and 98.6	F.
2432 were		99.	F.
976 were		99.2	F.
811 were		99.4	F.

While this test practically confirms the general belief that the normal temperature of the body is about 98.6 F. it also shows that considerable variation from this register may exist in a healthy subject. The low temperatures were found as a rule during the early morning hours, and the higher ones later in the day. In a number of special experiments made with firemen and stokers, who were subjected to unusual heat, it was shown that as a rule their temperatures were no higher than those who were at work in other parts of the vessel. The equilibrium being probably maintained by profuse sweating, etc. Therefore it is unsafe to regard an elevated temperature in firemen, stokers, cooks, etc., as being due to their vocation. It was shown that excitement, etc., will raise the temperature a degree or so above the normal register. While it cannot be definitely stated just what degree of temperature

should be regarded as suspicious, or justify us in holding persons for observation, it is the rule of this department to detail all those coming from infected ports, whose temperatures are above 99.5 F. unless the elevation of temperature can be satisfactorily explained. This may seem somewhat arbitrary particularly as in the great majority of cases this elevation is due to transient causes and may disappear within few hours. However, the fact that many cases of infectious disease in a mild or unrecognizable form have been detected principally by this means fully justifies this course. In the use of the thermometer on shipboard, the temperatures of the passengers should be taken first for the reason that these persons are subject to greater tension and rather object to placing the thermometer in their mouth after the temperatures of the crew have been taken. From twenty to twenty-five thermometers may be used at one time, particularly if there is a large number of passengers on board. The thermometers should be cleaned each time after being used. This can be done by placing the instruments in a soup plate containing tepid water and soap or with a little carbolic acid; another soup plate containing tepid water alone should be prepared for rinsing the instruments. This should be done in full view of the passengers and crew and does away with the feeling particularly on the part of the passengers that the thermometers are not clean. Great care should be taken not to have the water too warm. A thermometer should never be placed in the mouth of a person until the register is examined immediately before its use, and a second test should be made before a passenger or member of the crew is removed for detention. Those who employ this aid in the detection of infectious disease will find that great care is necessary in the use of this instrument in order to secure its full value in the work to which I have just referred.

In order to detect infectious disease in an irregular form it is the rule of this department to remove for observation all cases of sickness on incoming vessels, the diagnosis of which cannot be definitely decided. The importance of this comes to us with additional force just at this time, when unfortunately we are dealing with certain foreign ports as well as sections of our country, which have been invaded by yellow fever, etc. The presence of yellow fever in a community usually gives rise to many theories as to the means by which it was introduced. It is alleged that ships coming from fruit ports, particularly where bananas are collected, commonly carry infected mosquitoes, and that this is largely responsible for some of the recent outbreaks of yellow fever. It would seem to me reasonable to consider whether or not in these instances the disease was not introduced by mild or unrecognized cases. Fruit vessels arrive at New York, as well as New Orleans, and other

southern ports from districts in Central America, etc., occasionally infected with yellow fever. These vessels are loaded in practically the same manner and subjected to the same exposure. On their arrival at New York they are unloaded at the dock by non-immunes. However, there is no evidence to show that anyone connected with the unloading of these vessels has contracted yellow fever at this port. The significance of this lies in the fact that yellow fever does not thrive here. Therefore, if those working about fruit ships at the docks in New York contracted yellow fever, it would be the best evidence that they contracted it through the medium of infected mosquitoes on board these vessels. As I have already stated this has not occurred. On the other hand, it does not by any means indicate the presence of infected mosquitoes in banana cargoes if a person who is unloading a banana vessel in New Orleans contracts yellow fever, inasmuch as in the city referred to which is within the yellow fever belt, mild or unrecognized cases frequently exist. It may be pertinently asked if no evidence has ever been presented to show that infected mosquitoes reach New York City on fruit vessels, which frequently come from districts infected with yellow fever, why should this class of vessel be regarded as a common agent of infection in southern ports. I believe that if careful investigation is made it will be found that outbreaks of yellow fever are commonly due to the presence of mild cases of the disease existing in regions where the *Stegomyia* propagates, and in order to detect this type of the disease the thermometer should be used in addition to other means of inspection even though the persons under observation have been five days or more from an infected port.

REVIEW OF DISINFECTION FOR 1904-1905.

By PROF. FRANKLIN C. ROBINSON, BRUNSWICK, ME.

An examination of the articles published on disinfection and sterilization since the review given at the meeting of last year, shows nothing of paramount importance in the way of novelty. Probably Flügge's article, (No. 29), is the most important one to health officers because of its clear statement of principles and practical directions. Reference to the original source is given and a few brief comments made.

Dr. Calamida (No. 1) confirms Cadeac's results that .5 miligram of sublimate per kilo of body weight removes this immunity of dogs, but he finds that the principle cannot be applied to hens owing to the greater activity of their leucocytes.

Alcohol as a disinfectant has been the subject of a number of articles in the journals during recent years. Dr. Russ (No. 2) gives a summary of these. The weight of opinion seems to be that alcohol from 40-60% is quite a strong germicide, but that lower and higher percentages are much weaker in their action. Two observers class it about midway between sublimate and carbolic acid in strength.

Whether it acts as a direct poison or indirectly through the water present is not yet established, but the weight of opinion seems to be that it acts directly. Perhaps the most interesting reference is to the work of Wirgin on the action of dilute alcohol on culture media. He shows that 8% alcohol added to bouillon cultures of anthrax, typhus, coli, prodigiosus, pyocyaneus, staph. pyog. aureus, and diphtheria destroyed them after two days, but that 4 and 3 per cent. alcohol acted much slower, and $\frac{1}{2}$ per cent. had little or no action. He found also that 37° C. was the best for rapid destruction of the germs by the alcohol, as it was best for their growth when the disinfectant was not present. He found that *coli* and *diphtheriae* were most resistant. When the action was allowed to continue for a long time (10-100 days) 5% alcohol was deadly to the germs enumerated above. Wirgin also shows that certain bacteria thrive better in weak alcohol than in media not containing it. The acetic acid bacteria, for example, flourish better in a 3-5% alcohol solution. He found also that anthrax grown upon agar containing 4-5% alcohol was non-spore forming, and that the formation of pigment was hindered or prevented entirely by traces of alcohol in the agar.

Spengler claimed that tubercle bacilli were so much more resistant to formaldehyde than common bacilli, that pure cultures of the former could be obtained by mixing small amounts of formaldehyde with sputa. But Dworetzky (No. 5) is unable to confirm the claim. He finds that formaldehyde destroys all the germs in tuberculous sputa with about equal ease.

Dr. Seitz (No. 6) shows that thorough cleansing with soap, water and brush is a very effective method of freeing the hands from infection, but that in all cases of special importance it should be supplemented by use of some disinfecting solution.

The unequal value of different cresol preparations as shown by different experimenters is well known. Fehrs now shows that this is due to the different proportion of the isomeric cresols present. The meta and para varieties are much more active than the ortho.

English experimenters have shown before that cyllin is an excellent disinfectant. German (No. 8) confirms their results.

In No. 9, Kausch continues his valuable review of new patented apparatus for disinfection. There seems to be a marked tendency to complexity in them.

The experiments cited in No. 10 are not confirmatory of the value of the method.

Nos. 12 and 13 are of rather theoretical than practical interest.

Metakalin (No. 14) is composed of 100 parts potassium meta cresolate, 25 parts hard soap, (sodium soap).

Potassium meta cresolate is $3(\text{C}_6\text{H}_4\text{CH}_2\text{OH})$, $\text{C}_6\text{H}_4\text{CH}_2\text{OK}$. Metakalin contains one-third more cresol than lysol does and experiments show that it is correspondingly stronger as a disinfectant.

Pure white castile soap has according to M. Rodet, (No. 15), a positive antiseptic and germicidal action. He found that a 5% solution would kill Eberth's bacillus in from 1-5 minutes. It was less active against staphylococcus, requiring hours instead of minutes. He found as others have that all germs of a given kind were not equally resistant, some requiring much longer action of the disinfectant for their destruction.

Among the new preparations, a combination of formaldehyde and hematoxylin is recommended as a good substitute for iodoform, having the advantage of cheapness, and being without odor or poisonous qualities. It is made as follows (No. 16):

Dissolve 1 kg. hematox. in 10 liters water and add 3 kg. 40% formaldehyde. Heat to boiling and gradually add with stirring $2\frac{1}{2}$ kg. HCl. Sp. gr. 1.12.

A precipitate forms and after ten minutes the whole is poured into

20-30 liters of cold water, let stand for twelve hours, then washed by decantation and filtered, and dried at low temperature.

It is a brown-red solid, without taste or odor. It is insoluble in water and dissolves with difficulty in ether, chloroform, and carbon bisulfid. It is readily soluble in acetic acid, alcohol glycerin, acetic ether, acetone, giving a blue-red solution.

Patents No. 147782 and 153381 (German) are for protection of methods for preparing sera for detecting different kinds of blood and other albuminous substances. (Adalbert Kurtek, Berlin, is patentee.)

German patent No. 154732 (F. Meyer in Braunschweig) describes a method of preserving blood, etc., unchanged.

A salt which contains water of crystallization as sodium phosphate or acetate is freed from this water, and the blood mixed with the dry salt in the same amount as the original water. It will be preserved unchanged. For example, 100 kg. of sodium phosphate contains 50 kg. water of cryst. and after this is removed 60 liters of fresh ox blood can be put with it and it will be taken up.

In his experiments Iakowleff (No. 17), proves that when a proper amount of water vapor is present in a room with the formaldehyde and added at the same time or immediately following, the penetration of the disinfectant is rapid, one thickness of cotton cloth hindering it but little. There is less penetration when the water vapor is added before the formaldehyde.

Dr. Noetel (No. 18) is convinced that the best and safest way to treat sputa of consumptives is to receive it in cups of burnable material filled with dry coffee grounds, wood pulp or other substances absorptive and inflammable. He gives experiments to show that the objection that these are unsafe by reason of particles flying out by currents of air is untenable. He is led to this recommendation because of general agreement of experimenters that no common disinfectant will destroy such germs in less than six hours. Clothing, he thinks, should be steamed or soaked for not less than five hours in a 25% solution of formalin. His article gives a good summary of all work to date on the subject.

Löwenstein's experiments (No. 19) show that a formalin addition to milk of not more than 1-5000 so changes the milk that rennet will not coagulate it after four days. Stronger additions work more rapidly. It affects the milk and not the ferment as other experiments showed.

Levy's article (No. 20) is a complete history of formaldehyde disinfection with a bibliography. His conclusion is highly favorable to its use substantially as recommended by Flügge of Breslau.

Dr. Oetiker (No. 22) comes to the conclusion that the only safe and cheap way of disinfecting sputa is to subject it in the dish to live steam

for 15 minutes, as recommended also by Borfinger. Bed-clothing can be safely treated with formaldehyde gas in the usual room disinfection if not thickly soiled, or soaked for two hours in a 1-1000 sublimate or 1½% lysol solution.

Dr. Sörgo (No. 23) agrees with Dworetzky (No. 5) that Spengler's method of using formalin to obtain pure tubercle bacilli is a failure.

The vapor from boiling alcohol solutions is more effective as a disinfectant than the solutions.

Dr. Erwold (No. 24) found that the vapor from alcoholic solutions of from 50-90% would kill all common pathogenic bacteria in one minute and that when 30-40% or absolute alcohol was used, the killing was within two or three minutes. The article contains a review of other work upon alcohol and its vapor as disinfectants.

Dr. Schäffer (No. 25) claims as result of his experiments that sublammin is much inferior to either alcohol or sublimate as a disinfectant, being less active and more costly. Kroenig (No. 3) admits the general fact, but defends sublammin as more convenient and cheaper.

Carboformal glowblocks are compressed mixtures of carbon and formaldehyde which burn slowly, giving off formaldehyde gas. Good results have been obtained by using them in small spaces, but Lindke (No. 26) failed to get equally good ones by using them in large rooms, which was to be expected considering that they make no provision for supplying the necessary water.

After trying a great many things, Dr. Vincent (No. 27) concludes that caustic soda solution, 10%, is the best to disinfect vessels containing tuberculous sputa.

Since the South African war, the English army administration has given a good deal of attention to the subject of pure drinking water for its troops in the field. A recent collection of devices is described in No. 28. They depend upon addition of chemicals, filtration, or heat. Among the chemicals used are bromin in capsules, iodine in tablets containing iodide and iodide of potassium with tartaric acid, bleaching powder and carbonate of soda, bisulfate of soda, permanganate, and copper sulfate. The portable filters were enlargements applied to carts of common domestic types. The heat devices were simple boilers or arrangements to heat water to sterilizing temperature.

Flügge's article (No. 29) cannot be briefly extracted. It is condensed as much as possible and should be read in full by those who have to arrange rules for disinfection. Doubtless the rules he lays down are too complicated to suit American conditions, but the general principles upon which they are based are universal. On one point he is very insistent, that cleansing, however well done, cannot take the place of

disinfection in case of the more important infectious diseases. Cleansing with soap and water as he clearly shows does not kill germs, but removes them from one place to another. It may thus be a means of spreading a disease rather than checking its spread. He admits, as all sanitarians do, that the disinfecting of a room is not the most important factor in stopping an epidemic, but claims that it has a value directly as a germ destroyer and indirectly as an object lesson to the people. But it loses both of these if not efficiently done.

It is somewhat confusing for a practical man to look over a review like this and get help in his work. The question comes to him inevitably, what disinfectants can I use about which there is no question? Especially what common and cheap ones?

My answer in brief is that there are a few common disinfectants the efficiency of which has been firmly established, namely, boiling water, hot soda solution (about 10% solution of sal soda in water), milk of lime (pieces of lime slaked to a milk), corrosive sublimate, and formaldehyde. I would add some of the cresol preparations except that they are patented and hence not cheap enough for common use in the United States. I leave out carbolic acid because of its poisonous properties, and chlorid of lime because of its uncertain composition. Nothing better or more effective is needed to disinfect feces and such matters than milk of lime; nothing to disinfect clothes or articles not injured thereby, than steam, hot water, or hot soda solution; for quick sterilization of the hands a 1-1000 sublimate solution is the best; and as a room disinfectant, formaldehyde properly used still holds the first place.

Of course, I use the word disinfection in its narrower sense as a destruction of bacteria. If its broader sense is considered, including insect destruction, then sulphurous acid is to be added. There is thus no need of the health officer worrying about the effectiveness of this or that patented disinfectant which he may be solicited to buy. They may be desirable for certain special uses, but should not displace the common things close at hand.

BIBLIOGRAPHY.

- (1) Action of sublimate to take away the immunity of animals to splenic fever, by Dante Calamida.
(Centralbl. für Parasit. u. Infections, 37, Heft 1.)
- (2) The bactericidal properties of alcohol by Victor Russ.
Same reference as (1.)
- (3) Sublamin as a hand disinfectant, Kroenig.
(Monatsschr. für Geburtsch u. Gynäk, 22, Heft 1.)

- (4) Comparison of the disinfecting and antiseptic properties of methyl, ethyl, propyl, butyl, anyl alcohols, G. Wirgin.
(*Zeitschr. für Hygiene u. Infections*, 46, p. 149.)
- (5) Pure cultures of tubercle bacilli by Spenler's method.
(A. Dworetzky, *Centralbl. f. Bakt.*, 37, p. 626.)
- (6) Hand infection and disinfection, O. Seitz.
(*Centralbl. f. Bakt.*, 37, p. 721.)
- (7) Disinfecting value of different brands of cresol soap solutions. L. Fehrs.
(Same reference as 6, p. 730.)
- (8) Concerning cyllin. German.
(*Centralbl. f. Bakt.*, 38, p. 237.)
- (9) New patented apparatus for disinfection. Kausch.
(*Centralbl. f. Bakt.*, 35, p. 753.)
- (10) Animal experiments to prove the value of the hot water and alcohol method of hand disinfection. Fühth and Meisel.
(*Arch. f. Gynäk.*, 72.)
- (11) New patented chemicals and apparatus for disinfection. Kausch.
(*Centralbl. f. Bakt.*, 36, p. 97.)
- (12) The killing of tubercle bacilli in milk. Rullman.
(*Münch. Med. Wochenschr.*, No. 12.)
- (13) Disinfection of the human skin. Tirelli.
(*Arch. p. le Scienze Med.*, 28, p. 22.)
- (14) Metakalin, a solid cresol soap preparation. G. Wesenberg.
(*Centralbl. f. Bakt.*, 38, p. 612.)
- (15) The antiseptic value of common soap. M. A. Rodet.
(*Centralbl. f. Bakt.*, 38, p. 748.)
- (16) New patented chemicals and apparatus for disinfection. Kausch.
(*Centralbl. f. Bakt.*, 36, p. 425.)
- (17) Penetration of gaseous disinfectants. Iakowleff.
(*Centralbl. f. Bakt.*, 36, p. 465.)
- (18) New patented apparatus for disinfection and sterilization. Kausch.
(*Centralbl. f. Bakt.*, 36, p. 545.)
- (19) Disinfection of tuberculous sputa in spit-cups and on clothing. Dr. Noetel.
(*Zeitschr. f. Hygiene u. Infections*, 1904, Heft 1.)
- (20) Action of formalin on milk and rennet. Löwenstein.
(*Zeitsch. f. Hygiene u. Infections*, 1904, Heft 2.)

- (21) Value and availability of formaldehyde disinfection. M. Levy.
(Deutsch. Vierteljahr. f. Oeffent. Gesundheits, 1905, Heft. 2.)
- (22) Disinfection of tuberculous sputa. Dr. Julia Oetiker.
(Zeitschr. f. Tubercul. u. Heilstatten, Band 6, Heft 6.)
- (23) Pure cultures of tubercle bacilli by formalin. Dr. Sorgo.
(Zeitschr. f. Tubercul. u. Heilstatten, Band 6, Heft 6.)
- (24) Disinfection experiments with alcohol vapor. Dr. Ewald.
(Hygienische Rundschau, 15, p. 61.)
- (25) Comparison of sublamin with sublimate and alcohol. Schäffer.
(Hygien. Rundsch., 15, p. 72.)
- (26) Use of carboformal glowblocks in disinfection. Lindke.
(Centralbl. f. Bakt., 35, p. 651.)
- (27) Disinfection of tuberculous sputa. Vincent.
(Revue D'Hygiene, 27, No. 1.)
- (28) Sterilizing water in the field.
(Sanitary Record, London, 35, No. 795.)
- (29) Improvements in disinfection. Flügge.
(Zeitschr. f. Hygiene u. Infections, 50, p. 381.)

DISCUSSION ON PROFESSOR ROBINSON'S REPORT.

MR. G. A. SOPER, of New York City. — I desire to say a word or two in support of Professor Robinson's report. I believe provision is not made for the continuation of the Committee on Disinfectants. It seems to me that there is very great need of such work as Professor Robinson mentioned as being done. I am seldom called on to advise in respect to the steps to be taken to suppress an epidemic of typhoid without finding at once a distinct conflict of opinion with regard to the disinfectants to be used, and those opinions are in conflict not merely among physicians in regard to disinfectants that should have small use in their practical application on a large scale, but among sanitary experts. There is need of simplifying the method. If nothing more is done than to find a way to disinfect the typhoid stool, great progress would be made. Perhaps but one typhoid stool out of a hundred or two hundred is really disinfected. There are almost no data in my possession to indicate to me how that should be done in a village farmhouse, or in the average city home, or how to determine in the presence of an epidemic of typhoid whether it is done. If the committee can be encouraged in any way by action taken here, it should be done.

LESSONS TO BE LEARNED FROM THE PRESENT OUT-BREAK OF YELLOW FEVER IN LOUISIANA.

By JAMES CARROLL, ASSISTANT SURGEON, U. S. ARMY, WASHINGTON, D. C.

The present seems to be a suitable occasion to invite attention to several points in connection with the epidemic occurrence of yellow fever in the United States at the present as well as at other times. In the discussion of the symposium on yellow fever at the meeting of the Association in Washington, in 1903, the writer called attention¹ to the necessity during the epidemic season for requiring physicians, in cities where yellow fever is prevailing or likely to prevail, to report promptly to the authorities all cases of fever of any kind, coming to their notice. This is necessary in order that there may be no delay in the institution of proper measures to protect the community against extension of the disease if it be yellow fever, for this extension will almost surely take place in the more southern latitudes if the patients are not protected from mosquitoes at the outset. If all cases of undetermined fever were promptly reported and at once protected from mosquitoes² it would hardly be possible for the disease to spread if it were yellow fever; on the other hand, where the physician waits for the appearance of black vomit the golden opportunity passes by, for it has been shown that in practically all cases the disease cannot be communicated after the fourth day of the fever. For this reason the diagnosis should be anticipated, and all febrile patients should be immediately protected from mosquitoes until it is shown by actual demonstration that they are not cases of this disease. Epidemics do not follow every introduction of yellow fever; mosquitoes becoming infected may die before they bite a non-immune, or the patients may happen to be treated in a locality free from *Stegomyia*. A group of cases of yellow fever occurring without black vomit usually receives the designation *bilious remittent fever*, a diagnosis that should be erased from our text books. Bilious remittent fever, acute in type and of short duration, appearing in the United States, is yellow fever, and it should be so regarded. Bilious remittent fever was formerly regarded as a type of malarial remittent, but that

¹Report of the Proceedings of the American Public Health Association, Vol. XXIX, p. 291.

Since this paper was read, I have been informed by Dr. E. Liceaga, president of the Superior Board of Health of Mexico, that the line of procedure indicated is now being followed in his country.

was before the use of the microscope was found to be necessary for a positive diagnosis of malarial infection. We know now that malarial fever is not a disease of cities, but of outlying districts, while the bilious remittent fever, so-called, has been recorded in the cities, in epidemic form, and in such intimate association with yellow fever that by some, the diseases were declared identical, and by others, the latter was said to be only a modification of the former. Most interesting and important in this connection is the statement cited by La Roche^{*} in his chapter on bilious remittent fever, that "The morbid appearances revealed on dissection are the same in remittent as in yellow fevers." This statement, however, was not wholly accepted by him, for he calls attention to the bronzed appearance of the liver in certain remittents, a condition that we know results only from malarial pigmentation. Now that we can so easily differentiate malarial remittent and typhoid fevers from yellow fever the diagnosis is much less difficult, except where yellow fever occurs as a complicating infection.

Our confreres in Havana have demonstrated to us that it is possible to prevent the epidemic occurrence of yellow fever, even while occasionally admitting cases of the disease into the heart of a city in which the climatic and other conditions are known to be most favorable for its extension in epidemic form, and in which there are more susceptible persons now than ever before. The method suggested here is in many respects similar to, and is based upon, the one adopted during the American occupation of Havana.

Since then it has been sufficiently demonstrated in 1903 and again in 1905, that under the lax system heretofore and now in vogue, yellow fever can easily secure a firm foothold in certain of the southern states and escape recognition until it has passed almost completely beyond control. On both the occasions cited the outbreak was suppressed or limited only by the intervention of the general government, which through the energetic action of the United States Public Health and Marine Hospital Service, finally succeeded in checking two epidemics that threatened to become little less than national calamities. Great credit is due to those officials for the success that was attained in spite of the extreme delicacy of the situation and the passive opposition encountered from many quarters.

Our experiences in Cuba have shown that for the exclusion and suppression of yellow fever absolute hygienic control is necessary, not only of the people at large but of the patients as well, and especially of the practicing physicians. The aim of modern medicine is the pre-

^{*} Yellow Fever, La Roche, Philadelphia, 1855, Vol. 1, p. 590.

vention of disease rather than its cure, and the safety and welfare of the thousands of persons exposed demand that the proper measures be instituted and rigidly enforced. No valid argument can be brought forward to show why the United States should not be kept as free from outbreaks of yellow fever as the city of Havana, its former endemic home, has been, during the past four years.

To attain this result the following requirements seem to be essential:

1. Our physicians, or at least those who are in control, must disabuse their minds of the impression that black vomit necessarily occurs in the majority of cases of yellow fever.

2. During the epidemic season, viz.: from May 1 to October 31, and in the epidemic zone, physicians should be required to report to the health authorities, immediately, all cases of fever of any kind that come under their observation, whether among their patients or not, and failure to do so should be made punishable under the law.

3. The board of health should be authorized to appoint, with proper compensation, a commission of three experts, all of whom should be men of high reputation as diagnosticians. It should be the duty of this commission to visit without delay all cases of fever reported to the health authorities, and the onus of diagnosis should rest upon the commission and not upon the attending physicians. They (the commission) should visit each patient daily until the diagnosis is established or the patient sent to a hospital, and they should forward promptly to the health department a written report at each visit. The commission should determine whether or not the patient shall be treated as a possible case of yellow fever and their decision should be final and obligatory upon all concerned.

4. All patients presenting the symptoms of yellow fever, and all cases not diagnosed but remaining under suspicion, should be promptly removed for treatment to a hospital especially located and provided with wire screens and mosquito nets, and the whole or a portion of which has been set apart for that purpose. The yellow fever wards or hospital should be under the direct control of the senior diagnosis commission and the patients should be treated by physicians appointed only on their recommendation and acting under their direction.

5. In exceptional cases, to be determined by the commission, patients under observation awaiting diagnosis could be treated in their homes beneath mosquito netting, and in rooms properly protected with wire screens, until the nature of the case had been finally settled to the satisfaction of the commission.

The commission and not the attending physician should be held responsible for the enforcement of all clinical measures necessary for the

protection of the community, and they should be empowered to employ such help as seemed in their judgment to be required. They should also be assisted at times by sub-commissions appointed on their recommendation.

Under such a system, conscientiously carried out, the occurrence of an epidemic of yellow fever in any city would become an impossibility. Objection cannot be made on the ground of expense if the members of the diagnosis commission are paid only for every visit to a patient; under such an arrangement the cost to the city would be trifling when compared with the losses now sustained by individuals and the whole community through the failure of practicing physicians to recognize and report mild cases of the disease. And herein lies the crucial point. The diagnosis must be anticipated and the proper precautionary measures be taken before the disease has fully declared itself. Diagnoses of malarial remittent, and above all of bilious remittent fever, must not be accepted as conclusive until the presence of malarial or other parasites has been demonstrated to the satisfaction of the members of the diagnosis commission. Attention was called two years ago⁴ to the fact that over and over again, since the time of Benjamin Rush, yellow fever has stalked abroad in our cities, unrecognized, under the guise of bilious remittent fever. The time has come when a diagnosis of bilious remittent fever should no longer be accepted for there is no such disease *per se*. We may have malarial fever complicated with jaundice, but this should not change the diagnosis of malaria any more than an accompanying icterus would change a diagnosis of typhoid fever. Similarly, a complication of malaria no longer justifies the diagnosis of typho-malarial fever, and that term has properly been discarded. In numerous instances it is stated in the records of the older epidemics of yellow fever that the disease was preceded by, or began as, a bilious remittent fever, just as in more recent times physicians have believed that typhoid fever began as malarial fever. The conclusion is equally untenable in both cases, and the deduction is obvious that cases of so-called bilious remittent fever must be regarded and treated as cases of yellow fever, unless a satisfactory specific cause for the condition can be demonstrated beyond a doubt. It is proper to mention here, that in every one of the twenty-two cases of yellow fever purposely inoculated by the Army Board in Cuba, a diagnosis of bilious remittent fever would have been justified if it had not been known that they were produced from true cases of

⁴ Journal of the Association of Military Surgeons, 1903, (No. 4), Vol. XIII, pp. 193, 199 and 200.

yellow fever, for, although some of them were severe, black vomit was absent from all.

It may seem unnecessarily severe to require physicians, under penalty, to report all cases of fever coming under their observation, but no other means will attain the desired results, and the enormous interests at stake demand that the methods instituted be thorough and that they be rigidly carried out. The appointment of a board of diagnosis as has been suggested will relieve the attending physician from the odium that accompanies a diagnosis of yellow fever in a doubtful case, and the board, fully appreciating the responsibility that rests upon them, may be relied upon to do their duty. During the discussion upon yellow fever before this Association at its meeting in Washington, two years ago, already referred to, in my remarks, which were badly misquoted,⁵ I urged the necessity for requiring physicians, under a penalty, to report all cases of fever in order that they might be examined by a board of experts (as was done in Cuba), and treated as cases of yellow fever until the diagnosis was established. Only last month in a conversation upon this subject with a physician from a large city in Texas, he laughingly remarked, "We never report our cases of yellow fever until we have about a dozen of them!"

The present epidemic in and about New Orleans only serves to emphasize the necessity for such regulations as are here suggested, and this necessity is further emphasized by the statement in the public press of September 5, that "Inspector Brady attributed the continued spread of the disease to the unwillingness or inability of physicians to diagnose mild cases of yellow fever, and that physicians of standing and ability look for black vomit before making a diagnosis." I have elsewhere⁶ cited the occurrence of the same difficulty at Key West in 1899, and I again assert that these physicians may be thoroughly conscientious and able men, but they are baffled by the differences between the aspects of the disease as they actually find it and as they have been taught by the best authorities to expect to find it. It is the manifest duty of local health authorities therefore to relieve the physician of the burden of diagnosis and to leave that and the adoption of protective measures to the board of expert diagnosticians.

In this connection I beg to be permitted to call attention to the present situation at Jackson Barracks, a station of two batteries of coast artillery, in New Orleans. By the 7th day of the present month a

⁵ Reports of the Proceedings of American Public Health Association, Vol. XXIX, 1904, p. 291.

⁶ Journal of the Association of Military Surgeons, 1903, Vol. XIII, No. 4, p. 201.

number of cases of yellow fever had appeared in the neighborhood and seven of them in a block that approached within one hundred feet of the officers' quarters. Still the garrison has not been removed and up to the present time no single case has occurred among them; even should a case or two appear an epidemic is not feared. The reason for this is simply that the medical officers know that it is absolutely within their power to prevent any epidemic extension of the disease; they are constantly on the alert and all cases of fever are handled in the beginning as though they might be yellow fever.

Again at Fort McIntosh, in Laredo, Texas, in 1903 there were only five cases of yellow fever in a command of one hundred and eleven officers and men, while in the town along side them over one thousand cases and more than one hundred deaths occurred. It was found that the five men who became infected had violated orders by visiting the town at night without wearing the prescribed mosquito head-nets, leather gauntlets and leggings.

If, in the presence of cases of yellow fever among and around them, garrisons of soldiers can be protected from the infection in anything like epidemic form, it necessarily follows that the same measures and the same degree of vigilance will protect a community, provided the physicians do their full duty, and they are properly assisted by the authorities. The subject is one involving the lives and interests of thousands of innocent persons and the secret of success lies in eternal vigilance with the determination to allow no case, however mild and doubtful, to escape the fullest precautions.

SOME NEW POINTS IN THE ETIOLOGY AND SYMPTOM- ATOLOGY OF YELLOW FEVER.

BY JUAN GUITERAS, M. D., HAVANA, CUBA.

MR. PRESIDENT AND MEMBERS OF THE ASSOCIATION:— I am very sorry that I have not a carefully prepared paper to present to the Association; but my duties in New Orleans, Pensacola, and through the South, have prevented me. I can therefore only put together some rather desultory remarks concerning new points that have been brought out in the struggle with yellow fever during the present year or by investigators in distant parts.

The French Commission from the Pasteur Institute, working in Rio Janeiro, report that they have produced a case of yellow fever by applying to a non-immune a mosquito that had been raised from eggs laid by an infected mosquito. This brings up the question of the transmission of yellow fever by the progeny of infected mosquitoes. This is entirely a new point and of great interest, as you may well imagine. We thought that we had settled this matter in Havana in the negative. Dr. Carroll, speaking for the American Commission, and myself, speaking for the work I did at Las Animas Hospital, came to the conclusion that this was not so, that is, that an infected mosquito did not transmit infection to its progeny through the eggs. Though neither the American Commission nor myself carried out any special experiments in this direction, our experience, however, in the course of other experiments shows that the mosquitoes raised from infected insects were inoffensive. As a matter of fact, the majority of the mosquitoes we had to deal with, all the *Stegomyias* which we worked with in the laboratory at Las Animas Hospital were the progeny of infected mosquitoes. We started with infected mosquitoes and raised generation after generation from them. These were constantly fed by non-immune persons, by assistants in the laboratory, and by several men I had there ready to be bitten by mosquitoes. They were all non-immunes. We did not take any special note of this fact, but, in a general way, we were impressed with the non-transmissibility of the disease through the eggs to the progeny. There is, then, experimental proof of some value against the views of Marchoux and Simond, of the French Commission. Furthermore, these gentlemen have had positive results in one case alone, and, as they were working in infected

territory, it is quite possible that this man was bitten accidentally by an infected mosquito. There is another argument which I believe is of great importance against the transmission of the disease by the progeny. It seems to me it would have been really impossible for us to have eradicated yellow fever as we did in Havana if the views of Marchoux were correct. During the memorable campaign in that city the cases were quite often not seen until the second or third day of the disease, so that they surely had the opportunity of laying eggs before being killed; and the infected mosquitoes that were actually producing infections, they were laying eggs with but little hindrance, for, it must be remembered, that during that campaign the reduction in the number of *Stegomyias* in the city was scarcely appreciable. Really, if the French Commission be right, the problem becomes appalling, impossible of solution. We got rid of yellow fever in Havana very easily, and at little expense comparatively; this would have been, it appears to me, impossible if the progeny of infected mosquitoes had been also infected.

Another interesting point to which Marchoux and Simond, of the Pasteur Institute, called attention is one that has already been studied in this country. They seem to have ignored our work, or they are not familiar with it. They believe they have discovered a new source of infection of yellow fever in young children affected with mild forms of the disease. This is old. Dr. Blair, of Guiana, a great student of yellow fever; Dr. Chaillé, of New Orleans, and myself, in Key West and Havana, have shown previously that this was an important source of infection of yellow fever; that there were a great many cases of mild, unrecognized yellow fever amongst children; and that these were frequently unsuspected sources of infection. In fact, it was a study of this problem of yellow fever in young children in the yellow fever zone that led me to call attention to and to insist upon the fact of the great danger of mild cases of yellow fever. I have been insisting upon this point for many years, not only in the case of young children but also in adults, especially the colored population, who are apt to have mild cases of the disease. These I have always considered as the most dangerous transmitters of the infection.

I shall now take up some new diagnostic signs of yellow fever. We are all convinced of the importance of an early diagnosis of yellow fever, and I wish briefly to call attention to points of interest and of importance in enabling us to make an early diagnosis even in mild cases of the disease; of course, acknowledging that there are some cases in which an exact diagnosis is not possible, with our present means, and without our knowledge of the parasite of the disease.

These special symptoms we have brought out in recent work on yellow fever in Cuba, and which have been confirmed in New Orleans, are: In the first place, a high percentage of hemoglobin in the blood of yellow fever patients. That is a very important diagnostic sign of the disease, especially as distinguishing it from typhoid fever, malaria and influenza, three diseases that are frequently confounded with yellow fever. In influenza, typhoid fever and malaria, the percentage of hemoglobin is low — 70, 75, 80 perhaps. In yellow fever we have a high percentage of hemoglobin, very often 100, sometimes above 100, during the first three, four and five days of the disease, and rarely below 90. If the percentage of hemoglobin should go below 80, and the case should turn out to be one of yellow fever, we find almost always some complication or the patient has been suffering previously from malaria.

Another diagnostic point has been of considerable help to me during the present epidemic, especially in Florida, where we were confronted with the existence of an epidemic of dengue, and where the question came up quite frequently as to whether yellow fever was or was not present. I refer to the diazo-reaction of Ehrlich. The diazo-reaction of Ehrlich is an important diagnostic sign in typhoid fever in the first days of the disease. It may be present in other infectious diseases, but I doubt if it be ever present in uncomplicated yellow fever. On two occasions my mind has been completely relieved as to the existence of yellow fever during the past summer in the South by finding the Ehrlich diazo-reaction in the urine. I was able from my experience in Havana to exclude at once yellow fever. The Ehrlich reaction was found occasionally in severe cases of dengue.

Another diagnostic point that I wish to refer to is the albuminuria. We all know that albumin in the urine is a very characteristic symptom of yellow fever, but our judgment should be careful as to the interpretation that is to be given to the presence of albumin in the urine. After a careful study in Havana of many kinds of fever, we have found that albumin in the urine is more common in other acute infectious diseases than we thought. Albumin in the urine is common in influenza: it is quite common in typhoid fever; it is not so common, but is occasionally found, in cases of malaria. Albumin is found in the urine in cases of dengue. That is an important point. Some have been inclined to think that as long as we find albumin in the urine we have yellow fever, and not dengue.

The special point I wish to bring out is that the quantity of albumin in yellow fever is entirely out of proportion to the other symptoms present.

Let us take up the question from the point of view of dengue, which is perhaps the most interesting. If you have a patient taken sick, with a temperature of 104 degrees or more, and if the high temperature should persist for forty-eight hours or longer, you are very apt to find some albumin in the urine in dengue. But in yellow fever such temperature is indicative of severe infection. A temperature of 104 degrees, lasting over forty-eight hours, in yellow fever, means a very grave case, perhaps a fatal case, and such a patient is sure to have a large quantity of albumin in the urine and to be in a very critical condition about the sixth day, when the case of dengue will be getting well. A case of yellow fever beginning with such high temperatures will present the characteristic symptoms in a pronounced manner.

Let me say a few words in connection with the methods of disinfection that are being employed in New Orleans. From the beginning, understand clearly that there is a fundamental distinction to be drawn between the battle that is being fought in New Orleans and the battle that was fought in Havana. There is a fundamental difference between the two problems, and it is this: In Havana we attacked yellow fever at the beginning of the epidemic, a time when it should be attacked always. We began our operations in February. In Havana we had an epidemic of yellow fever, beginning every year in February and increasing in March, April and May, to the full development in August and September. In 1901 we began to attack this epidemic at the beginning of February, when there were only two or three cases. On the other hand, in New Orleans they began to attack the disease in the midst of the epidemic. This has never been done successfully, namely, to attack yellow fever and try to stop it in the midst of a great epidemic. This has been done this year in New Orleans, and with wonderful success. The epidemic has been checked; it has been brought to a standstill, although the authorities had to attack the epidemic under such unfavorable conditions in the midst of a very large non-immune population; probably the largest that was ever exposed to yellow fever within the limits of a city. New measures were, therefore, necessary to meet the circumstances and exigencies of the epidemic. In New Orleans they have attempted to destroy all mosquitoes in the city. They are fumigating all houses, whether they contain infected mosquitoes or not. Housewives have taken charge of this. It is perhaps the only way to deal with the disease under the conditions prevailing in New Orleans.

In Havana, on the other hand, we did not fumigate any houses except those that were infected, and those immediately adjoining. We applied the specific measures for the treatment of epidemics of yellow

fever; we killed the infected mosquitoes, and no others; that is, mosquitoes about the patients and those which were supposed to have bitten patients.

Now, is it necessary to follow the example of New Orleans? I am a little doubtful. I know that we are not able as yet to draw conclusions, but I was rather impressed with the fact that the attempt to do this great thing of disinfection of a city, of killing mosquitoes everywhere, rather weakened action against infected mosquitoes. A great deal of energy was spent in fumigating the whole city that perhaps might have been better employed if concentrated upon the infected mosquitoes only.

Another thing noticeable was that, after this great display of energy it was rather discouraging to find that no immediate results followed. The fever did not disappear rapidly. It was very discouraging, and there was an inclination to cast some doubt on the efficacy of the mosquito doctrine. The final success, however, may justify the process.

Another point to which I desire to call attention as new in the struggle against yellow fever is the use of steam under high pressure for the destruction of mosquitoes. That has not been used heretofore. The method was suggested and carried out by Dr. Berry, of the Marine Hospital Service. A fire engine was brought to the houses to be disinfected, and in certain places which were difficult to seal, as in courtyards and in stairways, a jet of steam was thrown against the walls and about the locality. In this way many insects were destroyed by the direct action of the superheated steam and by the force of the steam mechanically. That is an interesting departure.

Coming to one of the suggestions that was made by Dr. Carroll, as to the existence or appointment of a commission to make a diagnosis of yellow fever, no more important suggestion can be made, and I wish to speak decidedly in favor of it. It is the plan I adopted in Havana during the American intervention. We had such a commission then, and it is still in existence. This commission visits all cases of suspicious disease, and the opinion of the commission is final as to whether a case is one of yellow fever or not. There is, however, something more important than this commission, and that is the general education of the people. Take, for instance, such a commission as Dr. Carroll wishes to have appointed. Do you know what would have happened in New Orleans early this spring or this summer if there had been such a commission? The commission would not have been called in to see the suspicious cases. They would have been afraid to call it, because the people were not properly educated. It is necessary to educate the people, so that

the appearance of the first case of yellow fever may be reported at once without causing any excitement. Then, and only then, will capital cease to object to the timely reporting of cases of yellow fever.

It is to be regretted that some commercial interests in the South have thought that it was to their advantage to create the impression that yellow fever had made its appearance in Havana. For a while they succeeded in frightening Galveston and Mobile into quarantining against Havana. It is a pity, because Havana stood as a great object lesson to the South, and just when the South was beginning to believe in and profit from this lesson these foolish people have raised a cloud of doubt around the brilliant results that have been obtained, and are obtaining, in Havana.

YELLOW FEVER IN MEXICO.

BY DR. EDUARDO LICEAGA, MEXICO CITY, MEXICO.

As in former years, I come to give the Association an account of the course which the yellow fever has taken in the Republic of Mexico from the beginning of the year until the 31st of August, in order to continue thus the report which I brought to the meeting which took place in Havana in the month of January of the present year.

Although at first sight it would seem useless to again present the doctrine of the transmission of yellow fever, which has been accepted by the scientific world, I believe myself obliged to do so, for upon that doctrine is founded the procedure which we are following in Mexico in order to do away with the disease.

In order to transmit the yellow fever the concurrence of these three elements is needed: a yellow fever patient; a mosquito of the genus *Stegomyia*, which bites the patient, and a person not immune to receive the bite of the mosquito.

The problem of fighting the yellow fever consist then, in separating these three elements, and I am going to demonstrate the way in which these problems are solved in Mexico.

ISOLATION OF THE PATIENTS.

In order to separate a patient, the first thing to know is that the patient exists, and in order to find him we proceed in the following manner: In each village where there is yellow fever or it is feared that it will develop, we organize a *Sanitary Brigade*. Some of its members busy themselves in making a register of all the people who are not immune and who live in the locality. In this register a note is made of the age, sex, and nationality of each person and the place of his residence. The Sanitary Agents who form part of this brigade, divide the city or town, in which the fight is waged against yellow fever in such a way as to be able to visit the non-immunes daily. When one of these is found to have fever, whatever its origin may be, the patient is separated immediately, being put in a room whose windows have been provided with fine wire screens which will prevent the entrance of the mosquitoes, and a double door also of wire is provided, and so arranged that when the outside door is opened the inside one will automatically close and vice-versa. This can be done by means

of a chain of a certain length which unites the two doors. This is much more satisfactory than covering of the beds with mosquito netting, for the latter has to be opened frequently in order to observe the patient, to give him medicine, food, etc., and each time the curtain is opened you run the risk of letting a mosquito in, or should the curtain accidentally come in contact with the patient's body the mosquito can bite the patient from the outside of the curtain; whereas if the patient is in a room from which the mosquitoes have been previously driven out, and where they cannot come in again, the contact with the patient is impossible. This means of separation has another advantage, that is, that you may put in the same room a patient who has already been proved to have yellow fever and another whom they only suspect of having it, without the latter being liable to catch the disease.

As we have just seen, in our plan of campaign we do not wait until we are satisfied of the existence of yellow fever, but we isolate the patient from the first day that any fever appears, and consequently we isolate him during the first three days, which are the dangerous ones, and those in which the mosquitoes become infected. Experience has demonstrated the sufficiency of the methods we have adopted for the isolation of the sick.

DISINFECTION OF THE HOME OCCUPIED BY THE PATIENT.

During the time which elapses between the moment in which a person takes the yellow fever and that in which it is discovered by our agent, he may have been bitten by the mosquitoes and infected them, so that they are ready to spread the disease. In order to prevent this danger we proceed to disinfect the house as soon as it is left empty by the patient. The disinfection in this case has for its only object the destruction of the mosquitoes. In order to accomplish this we close the room as it is ordinarily closed, pasting manila paper over all cracks, and after this has been done we proceed to burn sulphur in the proportion of twenty grams per the cubic meter of capacity. The sulphur must be spread in a thin layer so that all will be burned. In this practice, which is so common and known to all, we have introduced another innovation which seems to me of great importance, and it is this: As it is very difficult to know whether the disinfection has been complete or not, we take some mosquitoes which have not been infected and which have been taken from the exterior of the room and put them in the farthest room from the one in which the sulphur is burned. These mosquitoes are put in open vessels, or which are only closed with a coarse cloth, so that it will allow the sulphurous acid to penetrate into

the vessel and prevent the mosquito from getting out. These mosquitoes serve us as witnesses. If, at the close of the disinfection, these mosquitoes which were in unfavorable conditions to suffer from the action of the sulphurous acid are found dead, we have proof that all the others in the same room and under more favorable conditions for receiving the sulphurous acid are dead also. If, on the contrary, we find them alive, it is a proof that the disinfection was not well done and that it will have to be repeated.

Already in the last meeting, I explained the way in which the huts, which in our country are called "jacales," are disinfected. I will therefore not have to repeat it now, and it will be all sufficient to state this fact, that there is not a house which cannot be made perfectly free of the mosquito.

In disinfecting Pullman cars, other railroad cars or any limited space where there are delicate objects which can be damaged we used formaldehyde.

In dry goods stores, where the sulphur, the pyrethrum and even the formaldehyde might alter the color of the merchandise we have used hydrocyanic acid, the result of which is as satisfactory as that of the sulphur and has not the objectionable effect that this presents of injuring the merchandise, but on the other hand it cannot be used except by a person who is very skillful in its use.

DESTRUCTION OF THE MOSQUITO LARVAE.

Another group of the sanitary agents is employed in making a daily house to house inspection of the cisterns which supply the families with water. If the deposit is found to contain larvae it is emptied and the place in which the water flows is covered with petroleum; the deposit is washed and the inside surface is searched in such a way that not a larvae is left alive, then it is filled with pure water and is covered with a close fitting lid, with a wire netting, or with a layer of petroleum. All the other deposits of water are covered with petroleum whatever their size, even when they are very small.

As you have just heard, those methods in which we have introduced innovations over those adopted in other countries are the following:

I. Making a register of the persons not immune.

II. Visiting the houses daily so that the patient can be discovered the same day that the disease begins.

III. The disuse of the mosquito curtains, because their use is insufficient to isolate the patient and the placing of patients in rooms whose windows are screened and which have double doors of wire netting.

IV. In order to convince ourselves that the disinfection has been complete we put mosquitoes in the house under favorable conditions so that they can be reached by the action of the disinfectant. If, at the close of the disinfection the test mosquitoes are dead, we can be sure that the disinfection was well done.

V. We have the means of making impossible the escape of the mosquito from the disinfected houses even if these are only huts whose walls and roofs are made of grass, or of branches or of any other penetrable material.

To prevent the disease from attacking a place where there are *Stegomyia*, we have proceeded in the following manner:

In all towns of this class we establish an inspection upon the arrival of the trains, and in other places where passengers reach the town on horseback, on foot or in carriages. Each passenger who is to remain in the locality is examined and is kept under watch by our sanitary agents, or by the police for five days after his arrival. In the places already invaded by the yellow fever, the same inspection is made of all the passengers who take the trains and they are prevented from leaving if they are ill and if they are not immune and have fever. Could not the passengers take the trains between the points where the inspections are made? The sanitary agent travels continually on the trains which traverse the infected districts, which are at present the small towns in the state of Veracruz and the towns traversed by the Tehuantepec Railroad, so that agents travel between Veracruz and Tierra Blanca; from Cordova to Tierra Blanca; from Tierra Blanca to Santa Lucrecia; from Coatzacoalcos to Santa Lucrecia; from Santa Lucrecia to Tehuantepec and Salina Cruz. If a patient is found on any of these routes he is taken to the nearest hospital and at night the Pullman or railroad car in which the patient traveled is disinfected.

Having thus organized our system of inspection we have followed it in Yucatan, notwithstanding the fact that since the 27th day of the month of November last not a single case of yellow fever has been found either in Merida, in Progreso or in any of the other towns of the state above mentioned. There has not been a single case of yellow fever in Veracruz since December 29th, 1904, up to July 4th of this year. In spite of the vigilance which we have exercised it is possible that a patient who did not arrive by the railroad nor by the most frequented roads has clandestinely entered the town and was able to remain hidden; and as he was not on the *Register* he was not visited by the sanitary agent. This is the only explanation which we can give of the appearance of this disease in the harbor of Veracruz. We have established a sanitary brigade and a lazaret in Tehuantepec, notwithstand-

ing the fact that the last case that originated in the town was observed on the 5th of December last, since another case which was found in April 26, was imported from Santa Lucrecia. Another service is established in Salina Cruz where the last case registered was on October 27, 1904. Lastly, in Tierra Blanca where a small focus was formed. Tierra Blanca is a village at the junction of the three branches of the Veracruz and Pacific Railroad. The village is composed of persons not immune who are employes and workmen on the railroad. As the village is cosmopolitan, and very poor and dirty, it has been truly difficult to completely extinguish the disease, and for that reason a brigade has been established there.

In the other places of the small infected zone, when isolated cases appear a physician and sanitary agents of some experience are sent immediately to proceed with the house to house inspection and to disinfect wherever it is necessary and to destroy the mosquito larvae.

There were 635 cases and 197 deaths registered in the Republic from January 1 to August 31, 1905.

The success which has been reached in Mexico in the struggle against yellow fever and the certainty that in a not far distant future the disease will be completely extinguished as has been done in the island of Cuba, can be easily seen from the statements already made.

THE CAUSE, COURSE, PREVENTION, AND TREATMENT OF BERIBERI.

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I shall not attempt more than to outline the results of my researches into the cause, course, and treatment of beriberi. Full details have already been published.¹

The cause of beriberi appears to be a bacillus which gains entrance to the alimentary canal in contaminated food and drink. It chooses for the site of its activity the contents of the stomach and small intestine, but chiefly the pylorus of the former and the duodenum. The bacillus, after causing a necrosis of the mucosa of these parts, with congestion and small-celled infiltration, invades the unhealthy mucosa and continues its work. At the site of its activity it appears to elaborate an extracellular toxin, which being absorbed into the circulation, poisons the peripheral terminations of the fibers in the different systems of neurons, and thus induces symmetric, bilateral, sensorimotor, cardiac, and vasomotor paralyses.

After a few weeks' activity, the bacillus and its toxin are eliminated, the paralyses which the toxin has induced either subside, or they resolve into narrower limits, and continue for months or years, until the subjects are carried off by an intercurrent disease or cardiac failure.

The causal bacillus of beriberi seems also to be able to accomplish its effects by invasion of an open wound. Therefore, we not infrequently see beriberi after surgical operation, in chronic ulcer cases, and in parturient women. In all classes of acute beriberi, the specific bacillus appears to induce its remote effects, paralysis, by means of an extracellular toxin carried to the neuronal terminations in the circulation. There is as yet no evidence that the bacillus extends within the body.

Upon clinical and postmortem observations extending over some six

¹ See the British Medical Journal, June, 1901; Studies from the Institute Medical Research, Federated Malay States, Vol. ii, No. 1, May, 1902; Brain, Winter Number, 1903-1904; Studies from Institute Medical Research, Vol. ii, No. 2, December, 1903; Journal of Hygiene, Vol. v, No. 2, April, 1905.

years, I have classified beriberi into (1) acute pernicious beriberi; (2) acute beriberi; (3) sub-acute beriberi; and (4) beriberic residual paralysis or the disease as it appears after the specific organism and its toxin have been eliminated and the engendered paralyses have failed to clear up.

Clinical Summary of Acute Pernicious Beriberi. — This form of the disease is rapidly fatal as the result of the severe impact of the beriberic virus on the cardiac nervous system. If one happens to be watching a community in which beriberi rages, it is observed that even the more robust members suddenly complain of symptoms that suggest acute indigestion. There is loss of appetite, or a disinclination for solid food, malaise, oppressive feelings in the deep epigastric region, cold or hot flushes in the legs or trunk, and sometimes sore throat. The throat is found reddened, pressure of the epigastrium is resented and causes obvious pain. The patient often indicates quite definitely that the epigastric sensations are deep, and in the position of the pylorus and duodenum. In a few days, or even hours, the knee jerks, disappear, rarely they become plus, a pretibial edema develops, subjective and objective sensory disturbances occur in the feet and legs, motor weakness of the peroneals and anterior tibials is demonstrable, the cardiac rhythm is found to be embryonic in character, or it gallops, one or several cardiac sounds reduplicate, hemic murmurs may be heard, the cardiac area extends with alarming rapidity to the right, a marked precardiac impulse contrasts with a weak irregular pulse, the cervical veins and epigastrium throb, dyspnea intrudes, delirium cordis develops, and in a few days or even hours the patient dies of cardiac failure. In the meantime the sensorimotor disturbances and edema have together, or separately, marched to the thighs, hands, arms, and trunk. The face may not escape, and not infrequently the diaphragm, pharynx, larynx, and the internal and external ocular muscles become involved.

Pathologic Summary. — The external appearance of the cadaver depends largely on the amount of edema which has developed before death. A general anasarca will mask other signs. Where edema has not extended beyond the legs, the cervical veins are greatly swollen. Rigor mortis is early if there has been a long agony. The eyes are partially closed and a bloodstained froth is found on the lips. The pharynx is moderately reddened. The serous cavities contain varying amounts of clear straw-colored fluid. The stomach and duodenum are toneless, dilated and empty. Their mucosa is deeply congested, rugæ and valvulæ are flattened and present numerous small hemorrhagic injections. Rings and patches of brilliant congestion occur, and prove to be markedly dilated capillaries. They suggest sprinklings of red pepper. This con-

gestion and injection may be found as low as the cecum; in a few instances I have found it in the ascending colon. As a rule it is most marked and occasionally wholly confined to the pylorus and duodenum. A thin pellicle of treacle-like mucus has occasionally to be stripped from the congested mucosa, but no true membrane is ever formed. Infrequently the congestion proceeds to hemorrhagic erosion of the gastroduodenal mucosa. The first chain of mesenteric glands is usually swollen. The liver, spleen and kidneys are markedly congested and may be moderately swollen, but in uncomplicated cases exhibit no other gross change. The contents of the thorax present a characteristic appearance. The lungs look massive from hypostatic congestion and edema of their bases, and from acute emphysema of their apices, and ventral borders. The heart looks large. It is only greatly dilated, especially the right chambers. The latter are full of dark semifluid clot. A moderate amount of similar clot occurs in the left ventricle. The right chambers are enormously dilated, the walls are thinned and the tricuspid is relatively incompetent. The muscle may have a greasy feel, but the fatty degeneration is not usually apparent to the naked eye. Occasionally the outer wall of the right ventricle is spongy and on pressure exudes a considerable amount of blood. The left ventricle is usually slightly dilated. There is no hypertrophy in uncomplicated cases. On the contrary, both right and left walls may be thinned. The encephalon and cord are normal looking, also the peripheral nerves.

Microscopically, the gastrointestinal mucosa exhibits all the signs of an acute inflammatory process. There is a more or less extensive small-celled infiltration, the vessels are engorged with red cells and leucocytes bearing debris, the epithelium of the villi and necks of the glands is markedly necrosed, and a small amount of fibrin has been precipitated. Lying between the necrosed cells and in the bodies of the glands, are varying numbers of a bacillus of constant morphologic character. In some instances it exists in pure culture, in others it is predominant. In length it is from 4 to 9 microns, and in breadth from 1 to 1.05 microns. The ends are slightly rounded. It stains with the ordinary basic dyes, and *is not to be decolorized by Gram*. All stains leave from one to three finely striated bars across the organism. The muscle fibers of the heart exhibit an extreme fatty degeneration. There is usually some fragmentation of the fibers of the right heart. There is also some dissociation of the individual fibers. A few foci of small cells are found beneath the membranes. The capillaries are crowded with red cells. The lungs exhibit the changes characteristic of hypostatic congestion and moderate edema. The kidneys are unchanged except the intense congestion. In uncomplicated cases there are no changes of note in the

liver and spleen. As in the kidneys, their vessels are crowded with erythrocytes. The nervous system is profoundly implicated. The effects of the beriberic toxin are exhibited by the peripheral terminations and trophic centers of the fibers. Sensory, motor and cardiac fibers show the same kind of change, though it differs somewhat in degree. Fibers first and most severely implicated, such as the anterior tibial and cardiac, react most plainly to Marchi. Of all the fibers implicated, the vagal are the most important, and so they will best serve as an example. Their terminations in the heart, in the gastroduodenal walls and in the deep cardiac plexus, exhibit by Marchi, black dots and dashes at the nodes and internodes. It is rare to see droplets of altered myelin. The medullary sheath does not appear to have broken down, but only to have been chemically changed. It is probable that the earliest act of the beriberic toxin is invisibly microchemic, and breaks the synapses between fiber and muscle or skin, followed by a visible chemic change in the medullary sheath readily detected by Marchi. In any event, the changes found in acute pernicious beriberi are not truly degenerative, but only toxic. In the vagal twigs, no single fiber termination is greatly changed, but every termination is poisoned. It is this that makes the poisoning of the vagal cardiac terminations so serious a matter. A few terminations completely destroyed would not cause death, but the moderate damage of the whole number soon leads to cardiac failure.

Acute beriberi in its clinical aspect differs from the acute pernicious form only in degree. The gastroduodenal syndrome which ushers in the disease is as marked, and the consequential paralyses, sensory disturbances and edema may be severe and widely distributed, but the terminations of the cardiac nervous system are never so deeply implicated. Death from cardiac failure is, therefore, a rare event in the early acute stage of the disease. When it does occur within the first 20 days or so, the anatomic changes are not different from those of acute pernicious beriberi.

Subacute beriberi is insidious in its onset, and patients seldom complain of or recall symptoms anterior to the actual edema and sensorimotor paralyses of the legs. The cardiac nervous system is but slightly, or not at all involved. The disease is not therefore, of itself fatal.

Course of Beriberi. — Cases of acute beriberi which do not succumb in the active, acute stage of the disease, follow one of two courses: First, they run a fairly definite course, ending in recovery. This is especially so when the disease is taken seriously and accorded the treatment usually meted to acute neuritis in an occidental hospital. About 15 or 20 days after the onset of the disease the symptoms of gastroduodenal irritation clear up, the slight pyrexia which may have been present

disappears, and the deep epigastric pain is no longer demonstrable. If the patient has been strictly confined to bed the edema will have almost vanished, and now subsides entirely. The sensorimotor disturbance ceases to spread, and soon begins to resolve. By the fifth or sixth week of the disease the heart rhythm has steadied, the cardiac area has contracted to normal, the motor paresis has disappeared, and except for the continued absence of the knee-jerks, the patient may be said to be well again.

The second course of beriberi is a serious one and generally incapacitates the subject for life. Up to the end of the third or fourth week cases in this category proceed as those in the first. The gastroduodenal irritation, deep epigastric pain, any pyrexia that has shown and the edema subside. The sensorimotor paresis contracts to the hands, arms, and legs, or altogether to the legs, and it looks as though the patient was about to reach normal. Then from some more or less obvious reason, such as that the patient is allowed on his feet too soon, or has not been compelled to rest from the onset, or because the impact of the beriberic virus has been crushing, there is a halt in the subsidence of the different paralyses and sensory disturbances. And now, what may have been an almost complete flaccid paresis, a wide affection of sensation, or a marked cardiac weakness and irregularity, resolves into narrowly confined atrophic paralysis of the legs, and arms perhaps, definite anesthesia of the legs, trophic changes in the tendons, and a weakness and irritability of the heart, troublesome on exertion. What has been a general anasarca remains so or fluctuates between that and edema of the legs. In course of time these residual paralyses become more marked, or some one predominates. It may be cardiac weakness, atrophic motor paralysis, anesthesia, analgesia or edema, and we then have beriberi, as most often seen in endemic areas.

It should be needless to point out that in these residual paralytics we have to do with nervous wrecks, left by the toxin of a specific organism long since eliminated. The real factor in these residual paralyses is not a toxin constantly acting, but the extension of a degenerative tendency imparted to the neuronal terminations by a toxin in the active, acute stage of the disease. The residual paralyses are, as a rule, confined to those sensorimotor and vasomotor areas which were the first to be implicated in the acute stage; to the cardiac and anterior tibial muscles, and the sensory areas of the legs and feet, for instance. As time passes the degeneration in these neuronal terminations, which do not recover on the elimination of the beriberic virus, not only extends laterally in each individual termination, but migrates along the fiber toward its trophic center.

For bases of beriberi which take this second course I have proposed the term, beriberic residual paralysis. This term may be modified so as to indicate which of the neuronal systems, cardiac, motor, sensory, or vasomotor is most deeply implicated.

Patients with beriberic residual paralysis may live for many years, depending largely upon the progress of the degeneration of the vagal cardiac fibers. Death is usually due to some cause inherent in the disease itself, generally cardiac failure, or to some intercurrent disease.

Pathologic Summary of Beriberic Residual Paralysis.—The appearance of the cadaver depends upon the duration of the disease, and upon the neuronal system most involved. There may be marked wasting of the leg, arm, and hand muscles. On the other hand, edema may be the salient feature. I propose to take for example a case of say two years' standing, in which the patient has finally succumbed to heart failure. If no rigor mortis is present, the wrist, ankle and knee-joints are remarkably loose. The latter permit of an extensive retroflexion. The stomach and small gut are generally slightly dilated, but there is a complete absence of the gastroduodenitis seen in the acute stage of the disease. Varying amounts of clear, straw-colored fluid are found in the abdominal and other serous cavities. The spleen is generally swollen and passively congested. A slight increase in the connective is sometimes present. The liver is round edged and passively congested. A moderate increase in the connective is found, and fatty and brown atrophy is common. The kidneys occasionally suggest cloudy swelling, but generally nothing but a marked passive congestion is present. The pancreas and other abdominal viscera exhibit nothing of note. The lungs are deeply congested at the bases and cut with more resistance than when normal. The apices and anterior borders are emphysematous. The heart is large. The right chambers are full of dark, semifluid clot. A small amount of similar clot is found in the left ventricle. The right side is, in the great majority of cases, eccentrically hypertrophied. In a small number there may be a thinning of the walls. A moderate hypertrophy of the left wall is not uncommon. The muscle is not firm and dark red, as is usual in hypertrophy, but fatty looking, and decidedly greasy to the finger. The whole organ is flabby. The tricuspid is generally relatively incompetent. The encephalon and cord appear normal to the naked eye. Nerve fibers to the atrophic muscles are thinned.

Microscopically, it is seen that the atrophy of the somatic muscles is of the parenchymatous type. Fatty degeneration and thinning of the individual fibers is more or less marked. The hepatic cells exhibit a moderate fatty and pigmentary degeneration. The portal canals are marked out by a moderate fibrosis. Foci of small cells are found beneath

the capsule and about the interlobular vessels. The capillaries are engorged with red cells. The glomerulæ and epithelium of the convoluted tubules of the kidneys are rarely fatty and cloudy. A few subcapsular foci of small cells are seen. The spleen, barring an extreme passive congestion, exhibits no change. The cardiac muscle is profoundly changed. Fatty and pigmentary degeneration is often combined and is always extreme. Rarely, there is a slight increase in the intermuscular connective tissue. Fragmentation of the fibers is not often seen. Foci of small cells are frequent beneath the membranes. A few of Remak's and Bidder's cells are always profoundly atrophied.

It is in the nervous system that we find the most remarkable changes. The slight poisoning in the acute stage has been succeeded by a true degeneration. Two factors are concerned in this conversion—the impact of toxin of great potentiality on neurons of low power of resistance, and inadequate treatment. The degeneration is not strictly terminal, as is the poisoning of the acute stage of the disease, but often migrates well toward the plexuses. I have never, however, even in cases of 15 years' duration, found degeneration in the plexuses. Between the centralward extension of the degeneration and the trophic cells there is always an hiatus. There is another important difference between the fibers as seen in residual paralytics and the acute stage of the disease. Whereas, in the latter, all the terminations in a given nerve twig are more or less poisoned, in the former only a moderate proportion are degenerated. The general poisoning of the acute, active stage of the disease, has resolved into a narrow degeneration of the residual stage of the disease. In the vagi, which we may take as an example, from a quarter to a third of the fiber terminations have failed to recover on the elimination of the beriberic toxin, but have developed a true degeneration, Wallerian in appearance. These degenerated fibers are not numerous enough to kill suddenly, but are in sufficient numbers to affect profoundly the nutrition and action of the heart (and plus strain), ultimately to cause death. What is true of the vagal cardiac fibers, is true in a general sense of the nerve fibers to the somatic muscles. The trophic centers in the cord and bulb of all atrophied fibers exhibit degenerative changes, the extent of which is closely related to the amount of degeneration in the fibers.

It will be seen that in beriberic residual paralysis, we have to deal with true degeneration causing atrophy, while in acute beriberi, we have to deal with a simple poisoning causing flaccid paresis.

Working Theory of the Cause and Nature of Beriberi.—Taking all the facts of beriberi into consideration, I have propounded the following theory as to the cause and nature of the disease: That it is an acute

infection with an incubation, of from 10 to 14 days; that the exciting cause is a specific bacillus not yet isolated; that this bacillus ordinarily effects its purpose by invading the alimentary canal; that the chief site of its activity is the contents and mucosa of the pylorus and duodenum; that its local action causes a necrosis and inflammatory reaction in the mucosa of the affected parts of the alimentary canal, which for convenience may be termed a gastroduodenitis; that its remote action is on the peripheral terminations of the nerve fibers by means of an extracellular toxin elaborated at the site of the local lesion; that the remote effects on the fiber terminations are of the nature of a poisoning, which rapidly clears up on the elimination of the causal organism and its virus; that nevertheless the impact of the virus on the terminations may be, and often is destructive in its tendency and so leads to true degeneration in the terminations, with consequent atrophic paralysis of the somatic muscles, anesthesia, and cardiac weakness; that the active stage of the specific bacillus is about three weeks; that the bacillus escapes in the feces and becomes deposited in dark, damp places, whence by the agency of flies, or by manipulation, it contaminates food and drink; that by the ingestion of such food and drink the disease arises again. The working theory includes the possibility that the specific organism may gain a wound, and through the agency of its toxin, give rise to acute beriberi minus the gastroduodenal irritation.

Stated concisely, beriberi is caused by a specific bacillus that, multiplying in a mucous surface or wound, elaborates an extracellular toxin, which induces its effects by poisoning and setting up a degenerative tendency in the peripheral terminations of sensorimotor and autonomic neurons.

Treatment of Beriberi. — In April, 1902, I made certain recommendations to the government of the Federated Malay States and Straits Settlements for the control of beriberi. They were based on the foregoing working theory of the disease, and were to be applied to the Kuala Lumpur gaol, where beriberi had been epidemic for seven years. The chief recommendations were that the ventilation of the gaol be improved; that the gaol be made dryer; that the entire gaol be disinfected at short intervals; that the prisoners be no longer permitted to defecate in their cells, and that all gaol work should be done in the open air so far as possible. It was also recommended that in all acute cases of beriberi the patients be isolated for a month; that their stools be treated as typhoid stools are treated. A long series of observations and investigations had convinced me that diet, considered as diet, was not an active factor in the causation of beriberi. It was therefore pointed out to the

authorities that so long as the diet of the prisoners was wholesome it need not be regarded.

Since the institution of these recommendations, the gaol diet has been of the standard that obtained when beriberi was epidemic. In spite of this, the result of the application of the hygienic measures has been most brilliant. Beriberi has, in fact, disappeared from the gaol. From August 1895, when beriberi invaded the gaol, to October, 1902, some 1,500 cases of beriberi had occurred in the gaol, among a daily average of about 400 inmates. The death rate had averaged about 20%, and another 15% were left in a state of residual paralysis. The application of the hygienic measures as outlined was begun in May, 1902, and became effective in October of the same year. Since November 1, 1902, there have been about 35 cases of beriberi, with no deaths, in a daily average of about 500 prisoners.

This reduction of the gaol beriberi was no accident; for in the surrounding country from which the inmates of the gaol are drawn, the disease has not at all abated. Table No. I is of the cases in the gaol just before and after the application of the hygienic measures. Table No. II is of the inmates of the District Hospital, Kuala Lumpur, which draws its patients from the area which feeds the gaol with prisoners.

TABLE I.—NUMBER OF CASES.

	1902.	1903.	1904.		1902.	1903.	1904.
January		6	0	July	38	0	3
February		0	0	August	26	0	0
March		0	3	September ...	28	1	0
April		0	0	October	32	1	0
May	64	0	0	November	4*	0	0
June	49	0	1	December	11	0	0
				Totals	252	8	7

* Hygienic measures effective.

The number of cases per month from May to October, 1902, indicate the prevalence of the disease for the years 1895 to May, 1902, that is, before the nature of beriberi was made clear. The number since October, 1902, indicates how controllable beriberi is by efficient hygienic measures, since I determined the nature of the disease.

TABLE II.

	Admissions.			Deaths.		
	1902.	1903.	1904.	1902.	1903.	1904.
January		67	48	.....	16	17
February		61	50	.....	7	11
March		61	73	.....	11	10
April		69	70	.....	12	9
May	84	67	.....	23	17	.....
June	67	80	.....	16	16	.....
July	67	52	.....	14	12	.....
August	56	57	.....	10	17	.....
September	40	51	.....	5	18	.....
October	54	80	.....	12	12	.....
November	55	85	.....	6	30	.....
December	67	66	.....	14	24	.....
Totals	490	796	241	110	192	47

This table clearly indicates that beriberi remained epidemic in the area from which the prisoners in the gaol were drawn. In view of these results, it may be stated with considerable assurance that a correct personal and institutional hygiene, such as would be directed against diphtheria or typhoid, will surely stamp out beriberi.

Medicinal Treatment of Beriberi. — It is evident that if the foregoing theory of the cause and nature of beriberi is correct, we have to deal with a disease which calls loudly for an antitoxin; but before this can be had, the specific bacillus must be isolated. I am working to that end now. In the meantime, the chief measure in the treatment of acute beriberi is rest in bed. Because the sensorimotor and cardiac disturbance is slight, the patients are, as a rule, permitted to wander at will. The result is that the moderate poisoning of the neurons is given a degenerative turn, and the paralyses, instead of clearing up on the elimination of the toxin, become fixed or more pronounced. I insist on rest in bed until the pains in the calves subside and the heart sounds approach the normal. If the preliminary gastroduodenal irritation marks the local action of the specific bacillus, as I am convinced it does, then calomel ought to be exhibited in small doses at short intervals. In the case of parturition or wound beriberi, carbolic, or other antiseptic lotions are called for. In the event of threatened cardiac failure, strophanthus is the best drug; for, undoubtedly, a factor in the circulatory disturbance of acute beriberi is a low peripheral pressure due to a poisoning of the nervivisorum. Strychnin should not be used in the acute stage of the

disease. Its action on the trophic cells of the acutely poisoned neurons would probably be more inimical than its benefit to the circulation. I have tried bleeding to relieve the distended heart in acute beriberi, but with questionable success. The best results are obtained in Sir Patrick Manson's clinic from absolute rest in bed and restriction of fluids. Rest in bed and the simple diuretics are also the best remedies for the edema.

In the stage of residual paralysis, remedies which have proved effective in other forms of chronic neuronal degeneration are called for. Gentle exercise, massage, electricity, and small dose of strychnin or arsenic. The cardiac condition should be closely watched. It will be recalled that the cardiac disturbance is due to two factors: (1) In time, degeneration in the vagal and accelerator nerve fibers; and (2) fatty and pigmentary atrophy sequel to it. Compensation is partially established by the hypertrophy of the ventricles, principally the right. When this breaks, digitalis and strophanthus may be employed. It is often well to combine with them some strong stimulant, injections of ether for instance. Morphin injections often relieve the dyspnea; but there is really nothing that so quickly relieves threatened cardiac failure and dyspnea as rest in bed.

BOSTON DAY CAMP FOR TUBERCULOSIS.

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The Boston Day Camp for Tuberculosis was modeled after somewhat similar institutions existing abroad of which a brief description would be in place. The scheme originated, as one might expect of advanced work for tuberculosis, in Berlin, in the summer of 1899, and has met with such success and appreciation that a recent report shows that there are six of these camps in Berlin alone and similar institutions in ten other cities of Germany, one each in Vienna, London, and in Mons, Belgium, while the number of nursing days has grown from 12,011 in 1900 to 132,936 in 1904.

A wooded tract of land is chosen easy of access from the crowded centres of population. This is enclosed by a fence and rude buildings are erected to serve as kitchen and dining-room and to furnish shelter in case of rain. Patients arrive early in the forenoon after taking breakfast at home, and are provided with lunches and a midday meal prepared on the ground. The day is spent outdoors under the guidance of a physician and nurse and in the evening the patients return to their homes for supper and to sleep. By the aid of the workmen's insurance in Germany each patient pays for his maintenance and the institutions are enabled to be self-supporting by buying the large quantities of milk there used at wholesale and selling it at the usual retail prices. The feature that has led to the almost incredible increase in the number of these institutions in so short a time is their cheapness and simplicity—a camp costing at the outset about \$1,000 and requiring little of organization.

It is the custom abroad to admit all classes of patients who need outdoor rest, although in actual practice about 75% of the cases are sufferers from tuberculosis. There are separate camps for men and women and a few camps especially for children. In the latter teachers are employed, so that as little schooling as possible is lost. The camps remain open from the first of May to the end of October. In the fall of 1904 one of the Berlin Camps was equipped with somewhat more substantial buildings and remained open throughout the following winter.

The first season of a similar camp in Boston is now nearing its close and the experience gained here may be useful to other communities wishing to offer at a minimum of expense a striking object lesson in the

advantages of the modern outdoor treatment for tuberculosis. The camp is conducted by the Boston Association for the Relief and Control of Tuberculosis, one of the numerous volunteer societies that have recently sprung into existence throughout the world for the purpose of popularizing the revelations of science about the Great White Plague.

It was late in the season before a suitable tract of land could be secured, so the camp was not opened until the 6th of July, thus losing two months when such a camp could be operated in this climate. The ground finally secured, though, is admirably adapted to the purpose, being an old orchard on the summit of Parker Hill, 230 feet above the sea, and in the Roxbury district, not more than two miles from the State House. Several street car lines converge at Roxbury Crossing, making it easily accessible to all parts of the metropolitan district.

From Roxbury Crossing, which is immediately at the foot of Parker Hill, the patients are carried to the camp in a park wagon seating 12 persons. The first trip up the hill starts at 8:00 A. M., the wagon running half hourly until all are at the camp.

On the lawn, amply shaded by old apple trees, are strewn steamer-chairs and couches where the patients rest throughout the day. Blankets are supplied so that the cool days of early fall are passed in comfort. Books and games have been donated to the camp and the women are allowed to bring their sewing. The camp, unlike those abroad, is restricted to patients suffering from pulmonary tuberculosis, and men, women, and children are admitted to the one institution. There seems to be no valid reason for separating the sexes in such a camp in America. Soon after all the patients have arrived in the morning a luncheon is served consisting of bread, butter, milk, and eggs when the latter are prescribed by the physician. At noon a warm dinner is served, consisting, in abundant variety, of meat, two vegetables, milk and a desert. At 3:30 P. M. another luncheon is served much like that of the morning, at either of which cocoa is offered on cool days. The average consumption of milk by each patient is one and one-half quarts per day, aside from what may be taken at home.

Patients in all stages of the disease are accepted for treatment on the recommendation of their own private physician or of any of the dispensaries and remain under the care of such private or dispensary physician during their stay at the camp. A physician is in attendance at the camp for at least two hours daily for general oversight. The matron is a trained nurse and during most of the summer has had a trained assistant. The patients are examined by the resident physician on entrance and monthly thereafter, are weighed once a week, and have their temperatures taken twice daily. In most cases there has been a marked

decrease in temperatures and in night sweats. In all instances were the patients able to sleep and eat better after a few days spent in the open air. Of 53 patients who have been in constant attendance during four to eleven weeks — for the camp did not fill on the opening day and there has been constant shifting of population since — of these 53, one showed on Sept. 21st neither gain nor loss in weight, 35 had gained an average of $4 \frac{4}{35}$ pounds, the greatest gain being $10\frac{1}{4}$ pounds; 17 patients had lost in weight, the average loss being $2 \frac{11}{17}$ pounds, and the greatest individual loss being 8 pounds. A number of patients were cared for who had been accepted for treatment at the State Sanatorium at Rutland and were awaiting admission; others came who had failed of admission at Rutland because of the advanced stage of the disease or unfavorable symptoms. Several of the latter so improved under the treatment at the Day-Camp that they were accepted at the State Sanatorium on second examination. For one woman, accepted at Rutland early in the summer but unable to go for domestic reasons, the Day-Camp has served admirably as a substitute, for the disease is now pronounced arrested and at the close of the season she will return to her household duties. The existence of a State Sanatorium with accommodations adequate for all who are recommended to it who are in the most incipient stages of tuberculosis makes it obvious that results obtained in a Day-Camp in a Massachusetts city would not compare favorably with what might be done where provision for early cases is less adequate.

Perhaps of equal value to the benefits accruing directly to the patient are those that come to his family and to the community at large from the instruction he receives in measures to prevent the communication of his disease to others. The efforts of the physician and nurses are largely expended on this side of their work and every detail of the camp life is watched with scrupulous care. Japanese paper handkerchiefs and paper bags are provided each patient for the disposal of his sputum, and are collected and burned daily. Patients are required to wash carefully before eating, and each is supplied with a clean towel each morning, which, with his own soap, he keeps in a box bearing his name. Besides the constant instruction given by those in charge several short simple addresses on hygiene have been given by one of the physicians from the tuberculosis clinic at the Boston Dispensary.

The entire plant and equipment cost about \$1,300, and consists of a kitchen and pantry equipped with a large range and hot water tank, sanitariums for men and women connected with the city water supply and sewer, a 20 ft. x 50 ft. dining tent with board floor, and three 10 ft. x 12 ft. tents, one for the use of the physician, one for storage of steamer

chairs and another for the use of the night watchman. The dining tables are covered with white oilcloth easily cleansed and figured dishes of light stoneware give a softening touch to the somewhat rude furnishings to be expected in a camp.

The staff comprises an attending physician who volunteers his services, a matron, nurse, cook and cook's helper, and a night watchman.

The camp has a capacity of 50 patients, which could be doubled at little expense by simply adding another dining tent. The cost per patient is about 40 cents per day exclusive of the cost of the team made necessary by the elevation of the camp and its distance from the street car line. The charge to the patient is 25 cents a day, although no one is excluded because of inability to pay this amount; in fact, few of the patients, as has been corroborated by investigation, are able to pay more than their car-fares to and from the foot of the hill. The camp will be discontinued for the season about November 1st.

Such a camp is in nowise to be compared with a properly equipped sanatorium, where the life of the patient is regulated throughout the full 24 hours of the day, but it admirably supplements the treatment given at home by private physician or dispensary to a large class of consumptives for whom there are no sanatorium facilities.

Its extraordinary cheapness as compared with the sanatorium and the striking object lesson it offers in the educational campaign that must be waged in every community may, as has been the experience abroad, lead to the establishment of many more such camps.

THE RELATION OF MILK TO TYPHOID FEVER IN NEW YORK CITY.

By J. S. BILLINGS, JR., M. D., NEW YORK CITY.

Early in the year 1903 the Department of Health began a special investigation of the cases of typhoid fever occurring in the City of New York, special attention being paid to the causation, sources of infection, etc. At present the Division of Communicable Diseases is charged with the sanitary supervision of typhoid fever in all boroughs of New York City. The routine procedure is as follows:

According to section 133 of the Sanitary Code of the Department of Health typhoid fever is classed as an infectious disease and every case must be reported. The section reads as follows:

SEC. 133. It shall be the duty of every physician to report to the Department of Health, in writing, the full name, age and address of every person suffering from any one of the infectious diseases included in the list appended, with the name of the disease, within twenty-four hours of the time when the case is first seen:

A. — Contagious (very readily communicable): Measles, etc.

B. — Communicable: Diphtheria, *Typhoid Fever*.

C. — Indirectly communicable (through intermediary host): Yellow fever, etc.

In accordance with the above, cases of typhoid fever are reported by means of:

- (a) Postal cards from physicians;
- (b) Postal cards from hospitals and institutions;
- (c) Specimens of blood and urine forwarded to the Diagnosis Laboratory for examination;
- (d) Citizens' complaints.
- (e) Death certificates.

A special history blank calling for all desired information is used, a sample of which follows:

DEPARTMENT OF HEALTH, THE CITY OF NEW YORK.

REPORT OF CASE OF TYPHOID FEVER.

Attending physicians are requested to fully and accurately fill out this blank and return the same in the enclosed stamped envelope to Dr. J. S. Billings, Jr., Division of Communicable Diseases, Department of Health, Sixth Avenue and 55th Street, New York.

Record No. Date Reported How Reported, P. B. O. T. C.
 Name Age Occupation
 Address Floor Private House, Boarding House
 Lodging House, Hotel, Apartment, Tenement, No. Families
 Sanitary Condition Attending Physician Address
 Patient how long on premises? Duration of illness
 Blood examined Results Date
 Spleen Enlarged? Rose Spots?
 Other Cases in Family House Friends
 Patient has Separate Room? Nurse?
 Did Patient Drink Milk Habitually? During Month Preceding Illness?
 Address Dairy
 Water Supply during month preceding illness: Bottled Croton
 Tank Did Patient Eat Raw Oysters? Whence Obtained?
 Was patient away from home for even part of a day and exposed to possibly infected water or milk during month preceding illness?
 Where? Date?
 Are all possible precautions being taken against spread of infection (disinfection of Urine, Stools, Bedding, Dishes, etc.?)
 Was Source of Information Reliable?
 What in your opinion was the source of infection? Infected Water? Milk? Oysters? Direct exposure to infection? Out of town infection?
 Remarks

In all cases reported by private physicians, either by card or by Widal specimens, such a blank history is sent to the attending physician together with the following letter:

DEAR SIR—The enclosed blank form is sent to you, with the request that you obtain from the patient, or, if that is not possible, from the patient's family, the desired information.

An addressed, stamped envelope is enclosed, in which kindly return the form as promptly as possible.

If at the expiration of two weeks no reply has been received the information will be obtained by an inspector of this Department.

Respectfully,

.....
 Chief of Division.

If no reply is received from the physician in two weeks it is taken for granted that an inspector of the Department may be sent to visit the case, which is done.

To special inspectors is assigned the duty of visiting all general hospitals at least once a week and obtaining full clinical histories of all new cases of typhoid fever. Such histories are then assigned to other inspectors who visit the homes of the patients and obtain the additional required information.

After the recovery of the patient, or his death, or his removal to a hospital, disinfection of the bedding is carried out, but no fumigation of the room is performed except by special request.

The cases of typhoid fever are grouped according to causation into five classes and plotted by means of different colored pins, upon large, compo-board maps of the five boroughs of the city. The cases are divided into five classes according to probable causation, as follows :

White: No source of infection known.

Red: Patients who were out of the city during the four weeks previous to illness.

Blue: Patients who were habitual or occasional consumers of raw milk.

Green: Patients who were occasional or habitual consumers of raw oysters.

Orange: Patients who were directly exposed to infection from patients ill with typhoid.

In visiting the houses of the patients the inspectors note all unsanitary conditions, the same being reported to and remedied either by this Department, or by the Tenement House Department.

A special circular has been prepared entitled "How to Avoid the Contraction and Prevent the Spread of Typhoid Fever." One of these is left at the home of every case visited by an inspector and one is sent to the private physician of every case with a request that it, or its equivalent be given to the family of the patient. In addition full verbal instructions are given by the inspector, as to the precautions to be observed. Where the diagnosis is doubtful the inspector takes specimens of blood and forwards them to the Diagnosis Laboratory for examination for the Widal reaction. In case of any obvious neglect on the part of the attending physician, he is visited and requested to remedy the faulty conditions. If this is not, or cannot be done, the patient is removed to a hospital. Knowledge of failure on the part of physicians to report their cases usually comes to the notice of the Department through death certificates. If such a case had not been reported during life, and had been under the physician's care for a week or more previous to death, an explanation is demanded, and an action in court brought against the physician if necessary. But practically all physicians now promptly

Turning now to the subject of this paper — the influence of milk — careful inquiry is made in every case as to whether the patient drank milk habitually or during the month preceding illness. If so, the dairy or store from which the milk was obtained is visited by an inspector who reports the condition of the dairy or store on the following card:

M

190

Location

Name

Permit No.....Amount sold.....

Cans are properly cooled

Temperature of milk

Dipper is clean

Store does.....connect with { living rooms
W. C. apartment

.....

.....

Medical Inspector.

A special so-called "Milk Index" is kept on the following card, which shows at a glance the number of cases of typhoid fever which have used milk from any one dairy:

Dealer Wholesale Retail Both

Address Name

Source of Supply.....

.....

In July, 1905, there took place a marked increase in the number of cases of typhoid fever in the Borough of Brooklyn — the weekly number of cases rising from 20 to 55. From that date the number of cases steadily increased until by Sept. 1st there were 1,287 cases and 195 deaths, as compared with 483 cases and 152 deaths for the same period of 1904. The epidemic was not very fatal — the mortality being about 15%. Of 1,081 cases plotted on the map of Brooklyn, according to the causation, in 360 no cause could be assigned (probably due to infected water). Four hundred and two were milk drinkers. In 196 the disease was contracted out of the city. In 95 the disease was contracted probably from another case in the family. In 27 there was a history of oysters having been eaten.

Investigation of the source of the milk supply showed that of 941 cases of typhoid fever occurring in Brooklyn, 244, or 38.7%, received their milk supply from one large wholesale and retail milk company.

Examination of the milk records in other boroughs showed that the per cent. of cases supplied by this same company was only 7%. It was at once thought that the cause of the epidemic was not far to seek, but further investigation showed that the milk of this company probably had nothing to do with the epidemic for the following reasons:

The company supply fully 75% of the milk consumed in the Borough of Brooklyn. Of 113 milk permits in one ward, this company had 89. Investigation of the company revealed the following facts:

The officials expressed themselves as being most desirous of assisting the Department and working with it in any investigation thought necessary or advisable. The company constantly employed a physician and a veterinarian who made inspections of the farms and cattle. Such an inspection had been recently made. Moreover, when the daily papers intimated that one or two milk companies might have been at fault in this local epidemic, a special inspection was made of all farms whence milk sent to Brooklyn was obtained. In all cases of illness on the farms supplying them, the company shut off the milk, but continued to pay for it according to contract, thus removing temptation to conceal illness. There was no illness known of among either dairymen or cattle. The company at once ordered another inspection made of the farms supplying Brooklyn — special attention being paid to possible water contamination. This inspection showed that there had been no cases of typhoid fever on said farms for over two years.

The above incident has been described in detail as showing how readily a biased observer might have ascribed the cause of the epidemic of typhoid fever in Brooklyn to infected milk. As a matter of fact,

investigation showed that the epidemic was probably due to infected water supply — such infection being caused by the unsanitary condition prevailing in Brooklyn. Driven wells abound in that borough, also leaky cesspools, broken sewers, etc.

During 1904, 1,786 cases of typhoid fever were reported in the Borough of Manhattan with 231 deaths — a mortality of 15%. In 351 cases no source of infection could be determined. In 210 cases the infection appeared to have been contracted outside the city; 378 cases were reported as consumers of raw milk. Of these, however, 203 cases had been out of the city within four weeks of the onset of the disease and 44 cases had consumed raw oysters during the month preceding their illness, thus only 131 cases gave a straight history of having used milk.

Bearing in mind that a great majority of persons use milk and cream, it is not to be wondered at that a history of such use is obtained in a large number of cases. It seems probable that the majority of cases of typhoid fever in New York City are due to infected water and that milk plays relatively a very small part in the spread of the disease. This conclusion is borne out by the recent epidemic of typhoid fever in Brooklyn, which was practically wiped out by the adoption on the part of the residents of that section of the wide-spread advice of this Department — boiling of water before using for drinking purposes.

It is true that in one or two instances family and neighborhood epidemics due to cases of typhoid fever in the family of the milkman in the city have been recognized and the contamination of the milk put a stop to. In one instance, a number of cases having occurred among the customers of a certain wholesale dairy, an investigation showing a number of suspicious fever cases on the farms in New York State whence the milk was obtained, issuance of milk by the dairy was stopped. Further investigation showed that the cases of fever in the country were not typhoid, and more cases developed in the city in the same locality, although none of that particular milk was being used.

The supervision of the milk supply of New York City by the Division of Inspection of the Department of Health is most careful and thorough. From the time it reaches the city until it is distributed to the users, its handling, storage and distribution are under the most careful supervision; but in the case of milk containing typhoid bacilli, this is only locking the stable door after the horse is stolen, as such contamination takes place on some one of the innumerable farms throughout the states of New York and New Jersey whence the whole-sale milk companies draw their supply.

It is true in most instances that these companies exercise the most careful supervision of all milk handled by them; yet routine inspection and supervision of all dairy farms is a thing that should be systematically carried out for financial as well as other reasons. It is outside the province and beyond the power of the Department of Health of New York City to carry out this work and the necessary money should be furnished to and utilized by the State.

A STUDY OF ASSOCIATIVE ACTION OF BACTERIA IN THE SOURING OF MILK.*

BY CHARLES E. MARSHALL, AGRICULTURAL COLLEGE, MICH.

For the last two years the attention of the writer has been directed to the determination of the favorable influence which certain micro-organisms, usually producing no acid, frequently digesting milk, and many times curdling milk, exert upon the growth of lactic bacteria (those germs commonly souring milk), accordingly hastening the souring process. It is understood that these lactic bacteria in milk cause the changing of the sugar of milk into an acid, called lactic acid, and this in turn acts upon the casein of the milk or the cheese content of the milk, producing a lopper. The bacteria which exert a favoring influence through a partial digestion of the milk, find their way into the milk through the filth of the stable, as hairs of the cow, dirt from the cow, dirt from the floor of the stable, dirt from the feed, dirt from the milking utensils, in fact, they reach the milk through any avenue which is likely to be contaminated in any degree with dirt of one nature or another. It follows, therefore, that there is present in the milk a mass of bacteria consisting of many kinds — those which are capable of souring milk directly; those which are capable of growing in milk and digesting it, leaving only a watery fluid behind; those which are capable of curdling the casein or cheese product under sweet or sour conditions; and many other kinds which are able to produce various alterations. Our associative studies in this instance are confined to the lactic bacteria and a few of those which usually digest milk without an appreciable formation of any acid.

It has been suspected for some time that the lactic type of bacteria does not always account for at least occasional peculiarities noticed in connection with the souring of milk. With the knowledge that this souring is produced by a definite lactic micro-organism in most instances, its isolation and its cultivation in sterile milk ought to yield the same results as one would succeed in getting in the souring of milk under dairy environments. This, however, is not always true. Through the discovery of these influencing micro-organisms upon the lactic germs, it is possible in part to explain many of the variations which occur in the production of sour milk by lactic bacteria.

* This paper is a resumé of more detailed technical papers published or publishing.

While the associative studies in connection with the souring of milk are more or less in an inceptive stage, they are along the same line as several other fermentations which have already been familiar for many years. The nature of vinegar fermentation, with which we are all somewhat acquainted, is something that will appeal to every layman not fully in touch with the technique of micro-biology. It is a matter of common knowledge that in the production of vinegar, alcohol is first manufactured by a yeast plant from the sugar of the fruit. Following the production of alcohol, bacteria develop which convert the alcohol produced by the yeast into an acid, called acetic acid, which yields the vinegar of commerce. This association is required to yield the proper fermentative results. The yeasts are practically necessary for the cultivation of the bacteria and the bacteria are essential for the production of acetic acid for vinegar. In several fermentations, associative life exists, as is met in kephir and koumiss, ginger beer, and others. Again, in disease mixed infection frequently occurs. This mixed infection many times hastens the development of the disease and perhaps there are cases where it acts as a hindrance. Diphtheria in its pure form is caused by a rod-shaped micro-organism and pursues a definite course, but when mixed with a certain spherical micro-organism, an aggravated form of the disease may follow. In the soil are instances of associative growth: for instance, it has been demonstrated that there is a distinct germ which is capable of liberating free nitrogen from combined nitrogen, but that this liberation does not take place through the agency of this germ very freely unless there is associated with it another micro-organism which is known as the colon germ.

These examples will be sufficient to meagerly illustrate the possibilities of association in a world of micro-organisms. Scientists recognize that certain plants grow only in the presence of other plants — again illustrating in the higher world the effect of associative development. This may doubtless be extended into the animal kingdom, and perhaps could be carried into regions which we know nothing about at the present time.

By the studies conducted in the Bacteriological Laboratory of the Michigan Agricultural College, it has been possible to demonstrate that when the lactic bacteria are associated with certain other bacteria the lactic germs are capable of producing a greater amount of acid through this association than when grown alone without the influence of any other germs; that the milk in which the two germs are grown will lopper sometimes as many as 72 times earlier than the milk in

which the lactic germs are grown alone; that the number of lactic germs also increases much more rapidly when under the influence of association than when alone. Allow A to stand for the lactic bacteria, B to stand for the associated type, then the following tables will illustrate the statements just made:

The gross changes in the milk may be indicated by the following scheme, temperature 20°-22° C. throughout:

20 hours after inoculation.

A = No change other than very slight reddening of litmus.

B = No change apparent in the milk.

A + B = Litmus redder than in A, but not so very marked.
No change in milk.

44 hours after inoculation.

A = Litmus red. No other change in milk apparent.

B = No apparent change in the milk.

A + B = Litmus reduced except very thin stratum of surface.
Firm curd.

68 hours after inoculation.

A = Litmus red throughout, no other change in milk apparent.

B = Very slight peptonization on immediate surface, but otherwise unchanged to eye.

A + B = Firm curd with whey separated. Litmus reduced except on immediate surface, where it is red.

92 hours after inoculation.

A = Litmus red throughout. No other change perceptible.

B = Milk peptonizing rapidly. Litmus is reduced in spots.

A + B = Firm curd with whey separated as in 68 hours. Litmus has become red throughout, probably through checked growth of micro-organisms and the permeation of curd by oxygen.

116 hours after inoculation.

A = Litmus red in upper half, lower half reduced. *Milk is beginning to lopper.*

B = Almost completely peptonized. Litmus reduced except in spots on surface, where it is still blue.

A + B = Same as at 92 hours.

141 hours after inoculation.

A = Curd separated from whey. Litmus reduced throughout except layer on surface.

B = Milk peptonized and slimy. Litmus blue on surface.

A + B = Same as at 92 hours.

The acidities of the cultures will be noted thus :

		Culture A.	Culture A + B.
0 hours after inoculation.....		18 degrees.....	18 degrees
23	"	24 "	32 "
49	"	38 "	56 "
			loppering
72	"	48 "	70 degrees
96	"	56 "	84 "
		loppering	
121	"	62 "	95 "

The ratio in the number of lactic germs developing in single and combined culture may be represented as follows:

$$A : A + B :: 27 : 1614$$

When only the products of germ B, instead of the living germs, are employed, similar results are obtained. The gross appearance of cultures :

Observations at the end of twenty-four hours.

The litmus in the milk in flasks 1, 2, 3, and 4 was slightly reddened only. There was no apparent change in milk. In flasks 5, 6, 7, and 8 the litmus was wholly reduced except a very thin layer on the immediate surface. The milk was a firm lopper with whey separated.

Observations at the end of forty-eight hours.

Litmus in milk in flasks, 1, 2, 3, and 4 redder than twenty-four hours previous. Milk still unchanged to naked eye. Flask cultures 5, 6, 7, and 8 remained as the day previous. Growth was checked and oxygen had permeated milk to half its depth, reddening the litmus.

Observations at the end of seventy-two hours.

Milk in flasks 1, 2, 3, and 4 was beginning to lopper. A thin layer of loppered milk had formed on bottom of flasks, but surface milk was still fluid. Litmus almost wholly reduced. Flask cultures 5, 6, 7, and 8 remained same as previously; the litmus had become red throughout.

The acidities of the cultures:

Flask-cultures.	0 hours old.	24 hours old.	46 hours old.	72 hours old.	96 hours old.
1	22°	30°	48°	62°	66°
2	22°	30°	46°	60°	66°
3	22°	30°	48°	62°	64°
4	22°	30°	48°	62°	66°
5	26°	72°	108°	112°	112°
6	26°	72°	106°	112°	110°
7	26°	70°	108°	112°	110°
8	26°	70°	108°	110°	110°

Note — (Flasks 1, 2, 3, 4 = Culture A without products of B.

Flasks 5, 6, 7, 8 = Culture A with products of B.)

The ratio in the number of lactic germs in culture A and A + B:

A : A + B :: 27 : 1007.

Since it was so plainly indicated in the work with the products manufactured by germ B in milk after a few hours' growth that the lactic germs responded favorably to their influence, it was suspected that ordinary milks contained germ products in greater or less quantities, some favorably influencing the growth of the lactic germs, others being indifferent, and still others antagonizing. These were considered a probable cause for the irregular results secured from somewhat varying or different milks. These products could be regarded as cleavage products resulting from the action of the germs upon the constituents of the milk, secretions of the germs, or a possible dissolution of the milk which is known to be very unstable, irrespective of germ life. Again, there was the possibility of finding that milks from different cows would respond differently to the influence of the same germ, even when sterilized within one hour after drawing. To arrive at some definite knowledge concerning these points, the writer began by testing milks as secured from the dairy and employed in the laboratory.

In testing milk, as it is obtained from the dairy, for cultural purposes, it has been noted in this laboratory that when subjected to heating at

20° it sometimes loppers and sometimes does not,

21° it sometimes loppers and sometimes does not,

22° it sometimes loppers and sometimes does not.

Of course, 22° milk is far more likely to lopper than 20° milk, but in this instance it is not the *customary action* which should be considered, but the *uncustomary*, for it is the deviation from normal conditions sought.

Bacteriologists have been aware of discrepancies occurring in milk culture work for some time, and have been somewhat at a loss to discover the cause for this. The behavior of certain species in milk could not always be confirmed, and error is the usual charge in a case of failure in confirmation. When irregularities do occur or are found, it were better to look for the specific reasons than to turn it off as unfathomable and personal. The author does not wish to express or draw any positive conclusions from his work on the variations of milk, but finds it essential to his studies with association; accordingly, he is compelled to give the results of some experiments conducted up to this time.

Three lots of milk were secured from the dairy at different times and were labeled as *fresh*, *fresh dairy*, and *old dairy* milk. The *fresh* was obtained from the stable, separated and sterilized within one hour after coming from the cow. The *fresh dairy* milk had been skimmed in the dairy and is what would be regarded as ordinary sweet dairy milk. The *old dairy* milk had been skimmed and stood in the dairy some time and had taken an upward start in acidity. These different lots were flaked, using an equal amount for each flask, and sterilized by the discontinuous method. After sterilization, into each flask was placed one c. cm. of a 1:1000000 dilution of a bouillon culture of germ B. These high dilutions of cultures have been found throughout our work as necessary to satisfactory measurement. When these milk cultures had stood for a time, a portion was tested by heating to determine whether it would curd or not, and at what point of time such curdling would take place with the different lots of milk. The following table will give the results:

Original milk designated as —	Original acidity.	Temperature maintained C.	Time of loppering by heating.	Acidity at time of loppering.
Fresh (stable).....	19°	21°	50 hours.	19°
Fresh (dairy)	20°	21°	47 hours.	20°
Old (dairy)	21°	21°	42 hours.	21°

Two explanations for these differences are possible: the one that germ B produces a certain amount of acid which in addition to that already present is sufficient to lopper the milk, earlier in the more acid

milk when subjected to heat, and later in the less acid; the other, there is formed an enzyme or product which in the presence of the acid of the more acid milk, manifests itself sooner when heat is applied. We assume in this case that the enzyme acts before sufficient heat has been applied to destroy it. Some space will be given later to the discussion of the possibility of an increased acidity in the development of germ B; consequently, it is unnecessary to enter into the question at this point other than to say that evidence in its favor appears meager. A very old culture of germ B, strongly alkaline, will throw down an abundant precipitate upon heating, and in most milks, cultures of germ B have to be well under way before curding will take place by the application of heat. If there is any question of increased acidity, it must be considered during the very early hours of the culture, for soon the alkalinity increases. The formation of a lab enzyme in sufficient quantities after several hours to curdle the milk seems more probable, yet even this explanation is by no means final, for this hypothesis and the facts do not coincide as fully as they ought. The cultures in milk show considerable advancement in digestion before loppering takes place. It is true that lab enzymes not infrequently form in the presence of peptic digestion, but are unable to manifest themselves on account of the rapid dissolution of the milk. To this it may be said that in some milk cultures curding takes place slightly, but perceptibly before much digestion has taken place, while in other milks there is no evidence of curding. In the heating of the cultures, too, the rapid rise of temperature would possibly destroy the enzyme. Of course there is a chance of enzymic action before the temperature becomes too high, yet so far as we can determine, the precipitation does not occur with the warming, but rather with the prolonged heating. To further elucidate this matter in hand, boiled sweet milk can be made to curdle in much the same manner as the flask cultures by the addition of some of a digested milk culture of B of long standing, which has been boiled and filtered. *This simple test confirms what has been suspected: The products, stable and not enzymic in nature, are able to produce a precipitation.* This has been demonstrated with cultures neutral in reaction to litmus and also decidedly alkaline to the same indicator. Neither acids nor enzymes but products of another nature apparently cause the curding upon heating. Perhaps we may later be able to show that different milks respond differently to the development of germ life because such products are formed more easily in some milks than others. The differences, therefore, manifested in the above table may be said to be due to the differences in the amount of products manufactured by germ B in the different lots of milk, and

further, the measure of the products would also measure the germ development which seemingly has some relation to the character or condition of the milk in which they are grown.

Another effort to ascertain the variability of different milks, employing germ A, will add to the evidence. In this instance, the time of curding and the measured acidity will serve as the key to the situation.

Lot of milk (dairy milk)	One.	Two.	Three.	Four.	Five.
Original acidity	15°	14°	16°	16°	14°
Number of germs introduced per c. cm.	692	692	692	692	692
Time of testing acidity of culture	120 hrs.	120 hrs.	120 hrs.	120 hrs.	120 hrs.
Acidity of culture	34°	23°	24°	37°	27°
Time of natural curding	148 hrs.	384 hrs.	264 hrs.	148 hrs.	275 hrs.
Temperature maintained	C 20°	20°	20°	20°	20°

The lots of milk employed in this test were secured from the dairy on different days, were inoculated with the same number of germs, were manipulated in the same manner, were maintained at the same temperature, and all the conditions were identical with the exception of the different lots of milk. The results, as indicated by the time of curding and the degree of acidity, are indeed irregular. In the employment of the same lot of milk, constancy and uniformity are very striking whenever the manipulative processes have been carefully executed. When beginning this work on association, this irregularity growing out of the employment of different lots of milk caused much confusion; fortune favored by requiring the same lot of milk in each test, as well as absolute uniformity in sterilizing and all other operations in its preparation. It is absolutely necessary to observe accuracy and uniform manipulation, otherwise the operator is likely to fail in associative studies. This may be illustrated by the use of a single lot of milk subjected to uniform treatment for studying cultural results.

Lot (dairy milk.)	One.	Two.	Three.	Four.
Number of germs introduced per c. cm....	249	249	249	249
Time of testing acidity	72 hrs.	72 hrs.	72 hrs.	72 hrs.
Acidity	62°	60°	62°	62°
Time of curding	55 hrs.	55 hrs.	55 hrs.	55 hrs.
Temperature maintained	23°	23°	23°	23°
Count of germs per 1-1000000 c. cm.....	112	113	111	112

The flask cultures moved along together in their development without any appreciable difference in appearance. They were as one flask.

Comparing such uniform results as obtained in the table just outlined with what has gone before, it follows that care must be exercised if constant interpretations are sought, and if dependence is to be placed upon milk cultural work from the bacteriological standpoint. Generally mixed milks are employed and these are more likely to be uniform than milk from individual cows.

Little attention is usually paid to the acidity of milk, although it has long been known that it is subject to great variation, because of its more or less indefiniteness, but in our bacteriological work it is possible that it plays an important rôle as possessing functions of its own or standing for a measurement of milk constituents, consequently some tests of our own determination are added to illustrate recorded knowledge which is not usually free of access.

	5/22	5/23
Red Polled (Pansey Belle).....	9°	.....
Grade 31	18°	16°
Holstein (College Houwtje)	5°	11°
Swiss (College Becky).....	13°	15°
Holstein (College Belle).....	14°	6°
Grade 11	17°	18°
Grade 17	18°	.....
Grade 32 .....	.....	19°
Holstein (College Houwtje Mae).....	.....	14°

From these tables it is safe to draw the conclusion that milk from different animals varies widely, as also does milk from the same animal.

If any conclusion is to be drawn from the evidence presented, and we must be very cautious in drawing a conclusion of any kind, it may be found in the well known fact that milk from different cows and from the same cow at different times varies widely and that this variation is capable of making itself manifest upon the development of micro-organisms, sometimes favoring, sometimes retarding, but at all times of sufficient importance to bear in mind when milk is used for cultural purposes.

My work extends sufficiently far to say that litmus added to milk causes irregularities in cultures, not among the litmus milk cultures

themselves, but when compared with the same lot of milk, as plain milk cultures. This has been very noticeable in our work, but as yet the work is too limited for prolonged discussion with contributing experimental facts. This subject of milk variation is not as well defined or as satisfactory as one would wish, but it has entered so largely into the work with association that to leave it out would fail of proper inference, and confirmation would become more difficult.

While we are compelled to admit that milk is subject to great variability traceable to the cow herself, yet we should not lose sight of the probability of products forming in milk as secondary products of germ action, giving rise to favorable or unfavorable influence upon primary fermentation as illustrated in our associative studies. It may be that these products at times are stable and toxic, and existing in quantities sufficient to produce gastro-intestinal disturbances. While the variation in the first instance may be regarded as physiological and normal, in the second instance it may be regarded as bacterial and abnormal. It has long been known that rennet in the making of cheese acts more readily upon milk which has ripened for some time than upon wholly fresh milk. So commonly recognized is this that cheese-makers employ more rennet in the curding of sweet milk than where a certain amount of acid has developed. Mr. H. C. Oven, working in this laboratory with the action of pepsin and rennet on milk, has contributed some data which confirms the chemical and bacteriological experiences given in the foregoing paragraphs.

PEPSIN THAT IS EMPLOYED FOR CHEESE MAKING.

Breed of cow.	9:30 a. m.	10:45 a. m.	3:00 p. m.
Ayrshire	10½ minutes..	13½ minutes..	12½ minutes..
Brown Swiss	4 minutes....	5 minutes....	4½ minutes...
Holstein 1.....	39½ minutes..	54 minutes...	No curding in 1½ hours.
Holstein 2.....	No curding in 1 hour...	No curding in 1 hour..	No curding in 1 hour...

The time in minutes represents the time required for curding. No curding in a definite time means that it was allowed to stand for the time stated without effect and observation was discontinued. The amount of pepsin employed was at the rate of 20 grams to 1000 lbs. of milk. The temperature maintained was 30° C.

Another test was made with rennet, such as is employed commonly by cheese-makers throughout the State.

RENNET.

Breed of cow.	9:00 a. m.	10:00 a. m.	11:00 a. m.	2:00 p. m.
Grade 1.....	14½ minutes.	20½ minutes.	29½ minutes.	17½ minutes.
Grade 2.....	19½ minutes.	38½ minutes.	40½ minutes.	23½ minutes.
Grade 3.....	13½ minutes.	21 minutes.	31½ minutes.	19 minutes.
Grade 4.....	12½ minutes.	23 minutes.	34½ minutes.	20½ minutes.

The time throughout the table is indicated in minutes. The amount of rennet used was at the rate of 4 oz. per 1000 lbs. of milk. The temperature maintained was 30° C.

*Here again, by the use of enzymes, it is possible to show a marked difference in the response of milk from different cows. It has been our experience throughout that the grade animals give a more uniform milk and that the Holstein shows the lowest acidity, and is slowest to respond to rennet. The Holstein produces the lowest amount of solids, also. It would necessitate far more extensive tests to make the differences manifested by breeds of tenable significance for each breed. We mention this possibility without drawing conclusions so far as breeds are concerned. Our primary purpose is to establish the value of different milks or perhaps the inconstancy of milks in their relation to bacteriological conclusions. Chemically, this irregularity is recognized, but in bacteriology it has been disregarded too much.

When germ B, or the germ which we have employed in connection with the lactic bacteria, has grown in milk for different periods of time, certain definite changes are produced. Inasmuch as these changes give rise to the products which we have shown may influence the growth of lactic bacteria as much as living germs themselves, it is interesting to know what this breaking down or digesting of the milk may be. Studied from the chemical standpoint, we shall find that the casein or cheese substance of the milk is almost completely dissolved and in its place are simpler nitrogenous products, such as peptones, amido and ammonia compounds, as well as other products of more or less complete digestion.

* The action of rennet may be dependent upon the acidity of the milk, the acidity upon the dibasic and neutral phosphates and perhaps citrates present, consequently rennet action returns to the mineral constituents of milk, one of which probably figuring more largely than others is lime.

I.

	Percentage of Nitrogen.	
	Control flask sterile.	Culture flask germ B, 48 hours old.
Total nitrogen	.5474	.525
Casein	.4536	.2912
Albumin	.0224	.0182
Caseoses, peptones, etc.	.0252	.0874
Amido compounds	.0238	.0932
Ammonia	.0224	.035

II.

	Control flask sterile.	Culture six weeks old.
Total nitrogen	.4598	.4638
Casein	.3766	.0434
Albumin	.0252	.0000
Caseoses, peptones, etc.	.021	.0340
Amido compounds	.021	.2107
Ammonia	.016	.1757

It is impossible, from our present data, to definitely point out which of these products favorably hastens the growth of lactic bacteria. It may not be a single one, but several combined. At any rate, the digestion is doubtless the means of furnishing such products as will hasten the growth of lactic bacteria. It must be understood, too, that the products resulting from these particular germs are not identical with the products of all germs of this class, for we find germs which have apparently no influence whatever upon the growth of the lactic bacteria. This would indicate perhaps that instead of some of these main products of digestion, which are indicated in our discussion as being the cause of the facilitated growth, that a secondary product, which is not apparent at all in our analysis, is the real stimulant of the lactic bacteria.

We can further say that no acid is produced by germ B, which we have studied so thoroughly. Although when grown in milk germ B will in time curd the milk upon heating, we have demonstrated that it is not due to the presence of any acid, but to other products which are found in the digested milk. On the other hand, we also know that

germ B will establish an increased alkalinity as is not only capable of determination in milk, by chemical analyses of cultures, but also in saccharine bouillon.

	Check acidity.	Acidity of culture after ten days.
Saccharose bouillon	15°	6°
Dextrose bouillon	15°	10°
Lactose bouillon	15°	8°
Levalose bouillon	15°	14°
Starch bouillon	15°	15°

Many other germs seem to be capable of exerting the same influence as B upon A, but this is by no means universal. The appended data will assist in giving some definite idea of the action of other micro-organisms than germ B.

GERM 12100 AND GERM A.

Culture.	A.	12100 + A.
Age of culture.....	72 hours.	72 hours.
Temperature maintained C.....	23°	23°
Acidity	65°	80°
Character of culture.....	*	§
Count of micro-organisms.....	704,000,000 per c. cm.	916,000,000 per c. cm.

* Smooth, thick lopper.

§ Loppered and whey separated.

PROTEUS VULGARIS AND GERM A.

Culture.	A.	Proteus + A.
Age of culture.....	48 hours.	48 hours.
Temperature C.	22°	22°
Acidity	44°	59°
Character of culture.....	*	§
Count of micro-organisms.....	540,000,000	1,000,000,000

* Curd soft — no separation of whey. § Hard curd — whey separated.

MYCOIDES AND GERM A.

Culture.	Mycoides.	Mycoides + A.	A.
Acidity	20°	62°	20°
Time	48 hours.	48 hours.	48 hours.
Temperature	21°	21°	21°

PRODIGIOSUS AND GERM A.

Culture.	Prodigiosus.	Prodigiosus + A.	A.
Acidity	25°	40°	30°
Time	48 hours.	48 hours.	48 hours.
Temperature	21°	21°	21°

GERM 999 AND GERM A.

Culture.	999.	999 + A.	A.
Age of cultures	24 hours.	24 hours.	24 hours.
Temperature maintained C.	23°	23°	23°
Acidity	30°	92°	42°
Time	48 hours.	48 hours.	48 hours.
Character of culture	*	§	†

* Litmus blue; no lopper. § Litmus pink; loppered. † Litmus pink; no lopper.

GERM X AND GERM A.

Culture.	X.	X + A.	A.
Temperature maintained	23°	23°	23°
Acidity	42°	62°	48°
Time	72 hours.	72 hours.	72 hours.
Character of culture	*	§	†

* Litmus reduced; partly loppered. § Litmus reduced; loppered. † Litmus pink; loppering.

GERM 1077 AND GERM A.

Culture.	1077.	1077 + A.	A.
Temperature maintained	23°	23°	23°
Acidity	20°	60°	56°
Time	72 hours.	72 hours.	72 hours.
Character	*	§	†

* Litmus blue; no lopper. § Litmus reduced; loppered. † Litmus pink; loppered.

GERM 1055 AND GERM A.

Culture.	1055.	1055 + A.	A.
Temperature maintained	23°	23°	23°
Acidity	40°	64°	64°
Time	96 hours.	96 hours.	96 hours.
Character	*	§	†

* Litmus blue; unchanged. § Litmus pink; soft lopper. † Litmus pink; soft lopper.

GERM 1028 AND GERM A.

Culture.	1028.	1028 + A.	A.
Temperature maintained	23°	23°	23°
Acidity	13°	67°	67°
Time	120 hours.	120 hours.	120 hours.
Character	*	§	†

* Litmus blue; unchanged. § Litmus reduced; soft lopper not so thick as A. † Litmus pink; soft lopper.

GERM 1016 AND GERM A.

Culture.	1016.	1016 + A.	A.
Temperature maintained	23°	23°	23°
Acidity	13°	65°	66°
Time	120 hours.	120 hours.	120 hours.
Character	*	§	†

* Litmus blue; unchanged. § Litmus reduced; lopper not so advanced as A. † Litmus pink; soft lopper.

This association of germs studied may cast some light upon the peculiarities or irregularities of milk souring known to nearly everybody; it may be the means of giving a better basis for advocating purer milk for infant feeding and other purposes, since the products, at times perhaps toxic, are so stable; it has already given a more rational view of starters and their control, as well as of the extent of their possibilities; and it has made lactic fermentation one subject somewhat to other microbial factors which have not heretofore been recognized.

THE RELATION OF ANIMAL LIFE TO HUMAN DISEASE.

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When we speak to-day of the relation of animal life to the diseases of mankind we mean the infectious processes, for the thought that animal life may have some influence in the production of other than infectious diseases is so remote that it need not be considered at present.

Medical literature abounds in references to the possibilities for harm lurking in the infectious diseases of animals and in nearly every great epidemic animal diseases have been reported as precursors or attendants. Bold inferences have been drawn from mere relations in time and space and fanciful theories have had their day, such as the one that bovine tuberculosis was human syphilis in the cow.

The close association of man with domestic animals was a sufficient reason for unfounded inferences as well as certain true deductions. From the time that man became agricultural in the dim, uncertain past, animals have been his close associates. This relation, still very intimate in agriculture, is less so with the growing urban population of the world. But even in our densely populated cities we come in contact with dogs, cats, mice, rats and birds in our homes, and with horses on the streets. Everywhere are consumed the flesh and dairy products of cattle, the flesh of sheep, swine and horses, and of many varieties of game, both mammals and birds, of fishes and mollusks. We are beset by insect pests which parasitize upon our skin and draw our blood. In short, almost every one of the great divisions of animal life has one or more representatives which play some rôle indirectly benefitting or injuring human beings.

With the beginning of bacteriology the relation of animal life to human disease gradually emerged from a fog of possibilities and suppositions and each year has brought greater clearness and definition. Some old views are being abandoned, or at least greatly circumscribed, and new ones opened to investigation.

That the pathological relations between man and animals should be manifold and diverse naturally follows from the great diversity among the animals themselves. If we endeavor to group the human diseases associated with animals we find three main divisions:

1. Diseases common to man and animals.
2. Human diseases accidentally carried by animals or animal products.
3. Diseases resulting from a complex and intimate relation between man and some insect on the one hand and some microscopic parasite of both on the other.

The diseases which are generally spoken of as common to man and animals may be still further separated into two classes:

1. Diseases belonging to some animal species and occasionally transmitted to man, such as glanders, anthrax, foot-and-mouth disease, rabies, trichinosis, and echinococcus disease.
2. Diseases belonging to both animal and man, such as the bubonic plague and those due to certain tapeworms.

It is of interest to note that there are in fact no strictly human infectious diseases which are occasionally transmitted to animals spontaneously. There are human infections which can be inoculated into animals and this practice is largely made use of in the study of certain human diseases by the experimental and comparative method, but infection in the normal way by simple contact or cohabitation is unknown. It might appear to some that vaccinia in the cow is an exception to this general rule. It is now quite generally accepted that vaccinia had its origin in smallpox grafted upon the cow, and this theory is in closest accord with what we know of vaccinia on the one hand, and of infectious diseases in general on the other. But even in this case the disease is an inoculation-disease, implanted on the udder by the hands of the milker. The disease germ undergoes profound changes and remains permanently modified. As regards bubonic plague in which the play of the infection between human beings and rats seems to be perfectly free so that we might say that the infection belongs equally to man and to rats there is still some doubt as to the original source of the virus. Some authorities claim, and with much reason, that the plague is a disease of rats primarily. This view is not supported by R. Abel, who, after a painstaking examination of the literature dealing with the Black Death of the Middle Ages was unable to find any references to rats.

This scarcity of disease common to man and animals is most probably due to the gap existing between man and the animals he has domesticated. A much closer physiological relationship exists between man and the higher apes. This has recently had a rather striking confirmation in demonstrations of blood relationship by the precipitin test and the inoculability of syphilis upon the highest apes. It is of the utmost importance to man that so few infections may pass

between him and the higher animals. If we were compelled to share only a fraction of the infectious diseases belonging to the domestic animals, the progress of sanitation would make it necessary for us to get rid of such animals entirely, otherwise the control of these diseases would be impossible.

The second group of infections carried by animals or animal products is largely due to incomplete sanitary progress. The transmission of diseases by milk is at best a result of uncleanness in the handling of this product, and up to the present we are not aware of any specific infection of the cow carried to man in milk unless it be the microbe of foot-and-mouth disease, and rarely the bacillus of bovine tuberculosis. The diseases carried by milk are chiefly of human origin and the milk is simply a favorable vehicle. It is possible that the future may unearth certain infections belonging to the cow other than those mentioned which may make trouble in the human subject, but at present we do not know them. There are known cases of actinomycosis of the udder, but their relation to this disease in man seems problematical to say the least.

The agency of oysters and other shellfish is precisely similar to that of milk. These animals are not known to be afflicted with any parasitic or bacterial diseases dangerous to man, but they act apparently as more or less passive agents in bringing back to us the human infections consigned to sewage. Since both shell-fish and milk are dealt with in detail in another section of the program I content myself by referring to them here and thus briefly.

The common housefly is still another agency whose scope of activity remains to be more accurately determined. It has not been wholly neglected, for the works of Nuttall, Alice Hamilton, F. W. Lord and others have each in another way contributed important data convicting or exonerating this insect of certain practices. It still needs more detailed study, not only in the adult but in the larval stage, in order that measures pointing to the restriction of breeding may be more widely known and applied.

We may safely affirm that the common fly is a passive carrier of infectious agents and that it is not a true secondary host of any human infections, as is the case with certain species of mosquitoes, ticks and the tsé-tsé fly of Africa. These are all species which draw blood and this gives them the opportunity to act as intermediate hosts of certain well-known pathogenic organisms. Nevertheless the flies which abound near and in human dwellings are fit objects of study for the sanitarian. A better knowledge of their functions may lead to more

adequate measures for the prompt collection of refuse in which they breed than is now possible in large cities, owing to public indifference.

As regards the kind of infections carried by houseflies we must at present assume that they may carry on or in their bodies all kinds of infections, though the danger of such infections is greatly diminished by the inability of these flies to pierce the skin and inoculate. The chief danger lies in the contamination of foods consumed raw or of foods sterilized by cooking to which flies have access after this process is completed. In this regard as in so many others, the sterilization of foods by cooking and subsequent protection is a most valuable safeguard, and all practices favoring the consumption of foods raw or even partially cooked should be frowned upon by sanitary science unless some very well supported arguments are presented in opposition.

The diseases of mankind, transmitted by insects acting as necessary intermediate hosts are of world-wide importance. Malaria, yellow fever, sleeping-sickness, filariasis, and perhaps other still imperfectly known infectious diseases, are inoculated by insects and they are the ones which make the tropics such forbidden territory for the immigrant from temperate climates. Not only he himself but the domestic animals he brings with him are destroyed by the same or similar living agencies. To this group of diseases I shall only refer in passing, for they have been so widely discussed in recent years as to have become familiar even to the laity.

Perhaps that group of human diseases which is transmitted by the well-known domesticated animals and their products is still uppermost in our minds when we speak of animal diseases in their relation to the public health. It is these diseases which crop out sporadically in the practice of physicians and which often remain unrecognized because of their rarity and irregular course. It is the same diseases in animals upon which the practice of veterinary medicine is built and which have made it such an important adjunct to the health officer. It is to these diseases that I wish to devote the remaining pages of this communication.

Inasmuch as the object of investigating animal diseases is to find means of controlling and suppressing them if possible, I must point out before discussing this group of infections one great practical difficulty. In the group of diseases carried by insects, ticks and rats there can be no question at present that the termination of these carriers is to be aimed at. We know of no useful functions carried on by mosquitoes, flies and rats which we can not dispense with. But the group

of domesticated animals which may transmit to us certain of their diseases is most useful to us. The essentials of our dietary in health and disease are derived from domesticated animals. They yield many other valuable industrial products. Among them are our companions and load bearers. We have a double problem before us, to protect human lives and to promote the welfare of our animals as well. Hence the conflicting counsels in the suppression of the transmissible diseases and the need for conservatism.

The significance of animal parasites, so completely overshadowed by the bacteria since the beginnings of bacteriology is now gradually being recognized. Fortunately only a small number of human parasites are also the property of our domestic animals. Among these the most important are the *Taenia echinococcus*, that formidable and very small tapeworm of the dog, the beef and pork tapeworm and trichina. The occasional discovery of other animal parasites in man need not concern us here.

As regards *Taenia echinococcus*, it is well known that the cystic stage invades man and is a dangerous guest. It is found occasionally in our abattoirs in swine, but it is fortunately rare at present. It is far more common in Europe and its presence in man not infrequently demands surgical interference.

Of the other parasitic diseases due to animals, trichinosis is the only one of considerable importance. Thorough cooking of pork products is known to render it harmless, but in spite of this cases are discovered now and then, and H. U. Williams has found at autopsies nearly five per cent. of the bodies examined harboring trichinae. This figure cannot be made general since the individuals autopsied belong largely to the lower stratum of society.

Trichinosis in swine affords an illustration of the fact that we are occasionally willing to make sacrifices in the interest of foreign trade which we would not make for the general welfare. Owing to the demands of the German government, there has been built up an expensive system of inspecting animals, including pork for trichinae, destined for export. This inspection is not designed to protect the American consumer, but only the foreign customer. It is, however, highly probable that a considerable amount of the inspected meat is consumed in this country.

The system has undoubtedly done much good in calling attention to the necessity of inspecting all animals destined for food and all meat products. It has trained many men to recognize disease and has been an educational factor of no mean influence. Yet it may be well questioned why our central government should pay the cost of

inspection under the conditions under which it is made, rather than the packer, as is the case in the German system.

From the standpoint of public health perhaps the most notorious in recent years of the infectious animal diseases is bovine tuberculosis. Identified by Koch in his celebrated work of nearly a quarter of a century ago in its etiology with human tuberculosis this affection became a target for nearly every one who is endeavoring to fight the human disease. The human carriers of bacilli were for the time being forced to the background by the energy and the money spent in destroying infected cattle. To-day we know that the tubercle bacilli found in cattle can be readily distinguished from the tubercle bacilli found in the human disease with certain relatively rare exceptions. For in some forms of the human disease, notably in tuberculosis of the mesenteric glands, bacilli are now and then detected which are at present indistinguishable from those of cattle. Human and bovine tuberculosis can no longer be regarded as identical, however, and it remains for us to study most thoroughly those isolated cases in which bovine bacilli are found in order that we may know the conditions which favor such invasion.

Bovine tuberculosis for obvious reasons must remain a proscribed disease both in the interest of man, cattle and other domestic animals. There must be no backward step in the movement to restrict this disease, although opinions will differ as to the means by which the disease is to be controlled.

When the crusade against bovine tuberculosis started, it was proposed to destroy all animals which gave a positive tuberculin reaction. This drastic method is happily laid to rest and a more conservative and less costly procedure has taken its place. In the hands of individual owners, the old method may still score a triumph by completely eliminating tuberculosis from a given herd after a certain number of months or years.

The complete eradication of bovine tuberculosis is made difficult by the existence of mild, latent types of the disease which may recover. These react towards tuberculin as vigorously as the more advanced, clinically defined cases. In the destruction of animals attention has been therefore diverted from tuberculin as a guide and the effort has been to eliminate only those animals which discharge tubercle bacilli. The mere presence of a tuberculous focus within the body does not mean danger to man and cattle. It is only when tubercle bacilli are being discharged from the udder, the lungs, the uterus, or the skin that the environment is imperiled. It may be urged that the methods for detecting bacilli in the secretions and excretions are inadequate

and require time, but this is no reason for destroying immense numbers of cattle apparently well. It is rather a challenge for veterinary medicine to devise and improve methods for rapid as well as more accurate diagnosis.

If bovine bacilli easily infect man it is strange that the army of people employed in cow stables who are exposed, just as the cows themselves are, to bovine bacilli coughed up, should not yield a larger number of tuberculous patients. Possibly in early years of life, the mucous membranes are more easily invaded than in adult life. This harmonizes with the fact that the cases in which bovine bacilli were found were largely children.

The study of tuberculosis in Japan by Kitasato has amply demonstrated that human tuberculosis may flourish where bovine tuberculosis is almost unknown among native cattle, and where cows' milk forms a negligible part of the diet of infants and children. Even in that country the proportion of cases of tuberculosis starting in the digestive tract was found to be as high as in milk-consuming countries where bovine tuberculosis is common.

A most timely and efficient aid in the warfare upon bovine tuberculosis is the movement for cleaner milk gradually gaining strength. Whatever can be done to reduce the number of bacteria in milk, will indirectly aid the work against tuberculosis. For clean milk means a normal or nearly normal udder. It means that discharges from the uterus will be detected, and these are frequently due to tubercular processes. The demand for clean milk will eradicate all emaciated or sickly animals, many of which are tuberculous. In short, the crusade against dirty milk calls attention to all those defects which a cow shedding tubercle bacilli is likely to exhibit, and we may rest content that this movement will, at least for the present, meet the demands for milk free from tubercle bacilli.

Tuberculosis among other domestic mammals such as dogs, cats, and swine is derived from either bovine or human sources. The tubercle bacillus of birds possesses certain differential characters which distinguish it from mammalian bacilli even after years of cultivation. The disease in mammals other than cattle is of subordinate interest to the sanitarian, but it should not be wholly lost sight of, and it needs further study before its significance can be definitely estimated.

Another infectious disease which is now thoroughly disseminated over the entire civilized world and which is giving public health authorities considerable work to do, is glanders among horses.

Glanders and tuberculosis have much in common. The underlying principles governing infection and dissemination through the body

are nearly the same. From the standpoint of etiology there is, however, this important difference. There may at present be a reasonable doubt concerning the animal origin of any case of human tuberculosis with the chances preponderatingly in favor of its human origin, because we have a tubercle bacillus fitted to the human species and one fitted to cattle. In glanders of the human subject there can be no doubt that it is of equine origin, for there is no human glanders independent of horses.

When we proceed to examine the statistics of human and equine glanders we are at once struck with its wide prevalence in horses and its very restricted occurrence in man, in spite of the intimate association of many human beings with horses continually discharging glanders bacilli. Glanders, so far as we know, is not conveyed to man except by direct inoculation or the infection of a wound. But even this cannot explain the restricted occurrence in man, for wounds and abrasions are common among those handling horses. Possibly some association of the glanders bacillus with septic organisms in the discharges from nose or skin of the horse may explain the occasional invasion of the bacillus.

In the struggle against this disease the same difficulties have arisen which surround tuberculosis in cattle. The mallein test reveals a certain number of mild, latent, non-infective cases which probably get well. What to do with such frequently very valuable animals is not easily decided. It seems to me that here also conservative measures should prevail, and that the methods of diagnosis should be applied to determine whether glanders bacilli are being discharged or not. If the animal is disseminating glanders bacilli it should be destroyed. If not, it should be inspected at intervals and the mallein test applied until the reaction is negative or nearly so.

Human anthrax, is, to-day associated with animal products, rather than with the infected animals. Hides, hair and wool carry the disease from far distant, permanently infected countries into the heart of our large cities. Factories in which these products are utilized may infect streams and pastures and thus create enzootic foci dangerous to cattle, horses and sheep. Such foci are known to exist in our country, east, west, and south, and with a more intensive agriculture and a more distributed animal industry than now exists, anthrax may play a much more important part in our country than it does at present.

The anthrax bacillus differs essentially in its biological characters from the highly parasitic bacilli of tuberculosis and glanders. It survives in a resistant spore form and is capable of carrying on an

independent life in the soil. It must be attacked in two ways. Agriculture and public health must coöperate in preventing the formation of new enzootic foci and in circumscribing and suppressing those now in existence. The workmen in factories must be protected by a careful supervision of animal products coming from infected countries and their disinfection. All cases of anthrax in man should be studied with special reference to the source of infection.

Fortunately surgery combined with the use of a promising anthrax serum may take away much of the danger of this disease. The improvements in protective inoculation of animals made by Sobernheim by injecting a protective serum with the culture are destined to cheapen the process and at the same time strengthen the immunity over and above what has hitherto been attained by the Pasteur vaccine.

There is still one other infectious disease for which human beings and animals appear to be equally susceptible. Rabies or hydrophobia is a disease which stands quite by itself in its etiology, mode of dissemination and species susceptible to it. Its causal agent remains unknown, though certain bodies within the cells of the brain have recently been found to have at least diagnostic importance. It is the only one of the infectious diseases of unknown etiology which is inoculable into a large series of animals. All the others are restricted to one or two, rarely three different host species. It is also unique in this that it is disseminated only by inoculation through a wound.

Rabies as an infectious disease belongs to the dog and the wolf. From them it passes to other animals. Cats are also known to have conveyed it through their bite. In the dog and wolf the disease is perpetuated by this habit of inflicting wounds with their teeth. In other animals and in man the disease is not inoculated by them. The extermination of this disease in civilized communities depends upon the management of dogs. It would seem to be a comparatively easy thing to check and completely wipe out this disease, yet there are many obstacles to encounter. The fondness of the human being for the dog which at least with us makes men and women impatient of any restriction placed upon canines stands in the way. So does the laxity with which stray and ownerless dogs are dealt with. The variable and often long period of incubation of this disease makes it difficult to exercise sufficient control over exposed and suspected animals. There is, however, nothing to stand in the way of ridding our country of rabies if we really and earnestly desire to do so and make the necessary sacrifices.

There is another group of diseases having its source in the animal food supply which has received considerable attention in European

countries, and but little in our own. I refer to outbreaks known as meat-poisoning, which are characterized by more or less severe and even fatal attacks of gastro-enteritis. The animal food involved has come from cows, calves, horses and swine. The bacteria found have as a rule been related to the hog cholera or enteriditis group, and are perhaps identical with the recently discovered paratyphoid and paracolon groups of bacilli of man. There are, however, other bacteria involved in some of the outbreaks, notably the bacillus of botulism and *Proteus*. In Europe (England, Germany, Belgium, Norway, etc.), the diseases known as meat-poisoning have occurred generally in an epidemic form, because the meat from a single animal is sold in a restricted locality, such as a village or small town. As the animal in most instances is raised and slaughtered in the same community the source of an epidemic of gastro-enteritis is easily traced. In our own country it is far more difficult to trace the source of such diseases, because the meat supply comes from a distance, and parts of the same animal are scattered over a large territory.

The frequent occurrence of such epidemics in certain portions of Europe is in part due to the habit of eating meat raw. In England, however, outbreaks have been traced to meat preparations not sufficiently sterilized by cooking or baking. In our country, the taste for very rare beef is not much more elegant than that of the German for raw, spiced pork or beef.

With us the rearing of cattle on a large scale in thinly populated territories has operated against the prevalence of diseases which might lead to food poisoning. There is no likelihood that this mode of raising animals will continue indefinitely. With a denser population in the western states we shall inevitably adopt the methods of European countries and we shall then have to cope with the same diseases. It is even probable that they do occur among us at present but remain unrecognized. The various forms of gastro-enteritis known as ptomaine poisoning probably have in many instances the same etiology as cases of meat poisoning.

We are at present wholly unable to attach any precise significance to the many bacteria which live upon the mucous membranes of our domestic animals, such as various cocci and the varieties of colon bacilli, the streptococci and staphylococci of septic processes and the various anaërobic bacilli of the intestines. While we may not go far astray in claiming the harmlessness of most of them there is still ample justification for more thorough comparative study of these micro-organisms since there may be, among them, a small number of dangerous forms.

The experimental and comparative study of animal infections which has been going on for over twenty-five years, beginning with the earlier researches of Pasteur and Koch has had far more influence in the development of sounder theories of disease and has led to many more notable discoveries in that large field of parasitism, which shows its hand in almost every known malady, than most of us would be prepared to admit. The origin of new ideas and fruitful theories is almost never contemporaneous with their acknowledged discovery. Discoveries are often simple explosions of material suitably prepared long beforehand. Much of this material has been laboriously brought together during the investigations dealing with animal diseases. To it we owe above all a strengthening of certain principles and doctrines among which the most important are the latency of certain infectious agents in the body and their persistence in certain diseases after recovery. The broader study of infection has also emphasized the mutual adaptation of host and parasite to one another leading to variations of immunity in the host and to specific variations of the parasite which circumscribe its power to invade other host species. Finally it has thoroughly demonstrated the necessity for looking primarily to living beings be they human or animal, as transmitters and disseminators of infection, and only secondarily to dead objects and fomites.

THE FEDERAL MEAT-INSPECTION SERVICE.

By D. E. SALMON, D. V. M.,

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It appears desirable at this time to call attention to the Federal meat-inspection service and the results which it is accomplishing. From a comparatively small beginning in 1891, this service has developed until in the year ending June 30, 1905, there were inspected at the time of slaughter the carcasses of 6,096,597 beef cattle, 845,862 calves, 7,872,671 sheep, and 25,323,984 hogs, a grand total of 40,139,114 carcasses. This is probably the largest meat-inspection service which has ever been organized under one head.

The inspectors are appointed after examination and certification by the Civil Service Commission; they have an annual salary, and all of their time is given to the meat-inspection work. They are on the killing floors of the abattoirs at all hours when killing is in progress, and they must see every carcass and pass upon it according to its actual condition.

During the year just closed there were condemned and tanked as offal 118,783 carcasses, and 158,968 parts of carcasses. Many of the condemned carcasses were affected with diseases which might have a serious influence upon the public health in case the carcasses were allowed to go upon the market for human food. Thus, there were 1,246 carcasses of beef and 24 carcasses of hogs condemned for actinomycosis; 10,956 carcasses of beef and 64,919 carcasses of hogs condemned for tuberculosis. Thirteen thousand five hundred and fifty-three hog carcasses were condemned for cholera or swine plague. One hundred and two carcasses of cattle and 1,066 carcasses of hogs were condemned on account of abscesses. Fifty-two carcasses of beef, 85 of mutton, 22 of veal and 304 of pork were condemned on account of enteritis. Three hundred and twenty-seven carcasses of beef, 73 of mutton, 36 of veal, and 535 of pork were condemned for peritonitis. Fifty-two carcasses of beef, 33 of mutton, 1 of veal, and 155 of pork were condemned for metritis. Two hundred and thirty-nine carcasses of beef, 208 of mutton, 60 of veal, and 877 of pork were condemned for septicemia. Four hundred and sixty-seven carcasses of beef, 190 of mutton, 68 of veal, and 2,978 of pork were condemned for pyemia. It will be admitted that carcasses affected by such diseases are a serious

menace to the health of the consumer, and that every care should be exercised to remove them from the channels of commerce and dispose of them in such a way that they can not be sold as edible meat.

The subject of tuberculosis in swine is become more important each year. During the last year one-fourth of one per cent. of all hog carcasses inspected were condemned on account of this disease. At some packing houses an average of about one and a half per cent. of a whole month's killing has been condemned for the same reason. The disease is evidently increasing, and it is important that an inquiry should be made to determine the manner in which it is being disseminated among these animals. The custom of allowing hogs to follow cattle during the fattening period, and eat the undigested corn which they find in the droppings, may have something to do with the transmission of this disease from cattle to swine; but it is likely that a more fertile cause will be found in unsterilized skim-milk from the creameries which is taken to the farms and fed to the swine. It is also possible that the breeding herds of pure-bred swine have been largely contaminated and that the disease is being distributed through the breeding stock. In whatever manner the infection is occurring, it is important that it should be traced and measures taken to bring it under control.

In this connection your attention is asked to the large number of slaughter-houses in the United States where no inspection is practiced. Some of the large hog-killing establishments are running without any inspection, and this one and a half per cent. of tubercular hog carcasses is probably being sold for human food, as well as most of the carcasses affected with the other diseases which have been enumerated. In nearly all parts of the country there are abattoirs in operation which have no professional inspection and which for that reason are unable to discriminate between healthy and unhealthy carcasses. In most cities the municipal inspection is practically worthless. There are not a sufficient number of inspectors to keep a constant watch at all the slaughter-houses, much less to see each carcass as it is killed and dressed. If there are any doubtful or plainly diseased carcasses they are usually disposed of by the butcher when the inspector is not present.

I make these statements as the result of many years' experience with the meat-inspection service, and I am fully convinced that something should be done to secure Federal inspection at all the houses doing an interstate trade, and a thorough municipal inspection at the houses in the various cities which are slaughtering for local consumption. Inspectors should in all cases be appointed on the merit system and should be sustained in the difficult duties which they have to perform.

The extension of the inspection service and its constant improvement is one of the most important objects for which this Association can work. There should be no slaughter-house running without inspection to which diseased animals can be taken in order to escape the condemnations at the houses where inspection is enforced.

A DISEASE OF CATTLE IN MEXICO.

BY DR. JOSE DE LA LUY GOMEZ, MEXICO CITY, MEXICO.

Ranilla is the term in the vernacular which is used in Mexico to indicate a disease that, in that country, attacks the cattle.

From an unedited work which I have written, and which I commenced in the year 1895, treating of this disease, I have taken the most material points to lay before this honorable Association and which deals with an etiological problem of comparative pathology.

This disease, which sometimes has assumed an enzootic form in certain points but is generally of a sporadic character, has caused a great disturbance in the progress and improvement of cattle, thereby counteracting individual efforts. It makes its appearance in the summer and autumn.

The appearance of the disease is preceded by an exaggerated exercise, a change in the food, in the drinking water or in the climate; the presence of the animals for some hours of the day in swampy lands after the first rains, and sudden chills.

The first stage of the disease generally passes unperceived; the animals still appear healthy, but later on they commence to show symptoms such as heaviness in their movements, a slight elevation in the temperature, which a careful watch will discover and appreciate; gastric and intestinal disturbances appear, such as a decrease of appetite, interruption of rumination, constipation or diarrhea in the last stage, with meteorism of varying intensity, whilst from the very beginning of the attack the urine contains albumen. The commencement of the disease is characterized by a curved spine.

As the disease progresses, the gastro-intestinal suffering becomes more pronounced and either constipation or diarrhea is continued. There is also hematuria; the discharge of urine is slight, and cases have been seen in which this function is paralyzed and the course of the disease is shortened; rumination is suspended, locomotion becomes difficult, in which case the sight becomes disturbed; the pulse is full and frequent, and the temperature during the course of the disease is 39, 40, 41.5 and 41.9 degrees, centigrade; the state of prostration increases with the disease, and the animals can only lie down with pain. Either in the beginning, or during the progress of the disease, some of the patients are observed to be suffering from illusions or

delirium, which alternate with stupor; and when they are in this state they have been observed to develop extraordinary force against the walls or mangers, furious temper and at the same time walking without any apparent guidance. In the young cattle the hematuria is exceptional.

This disease has a duration of six, twelve or eighteen days, the longest period being that of young animals, in which the diarrhea is frequently prolonged and leads them to stupor and death if they have not previously succumbed to an attack of pleuropneumonia. Cases have been seen in which the disease is of very brief duration, a circumstance that makes a profound impression on the cattlemen and veterinary surgeons, as its evolution only occupies from thirty to forty-eight hours.

On opening the stomach immediately after death, we find that congestion, hemorrhagical and inflammatory conditions prevail in the small intestine, in the mesenteric and intestinal glands, in the kidneys, spleen, liver, bladder and nervous centers.

The mesenteric and intestinal glands are swollen to double their volume with a reddish color or violet spots; the spleen is considerably infarcted, friable and dark red in its substance; the liver is congested and frequently presents yellow spots similar to the color which this organ assumes in its fatty granular degeneration; the biliary vesicle is distended, and contains a great quantity of bile; the kidneys are increased in volume, have a dark red color throughout or else some of the globes are stained, and the bladder contains sanguineous urine.

In one word, the lesions of the small intestine and surroundings of the mesenteric and intestinal glands, as well as of the kidneys and spleen, clinically form two groups:

1. Continuous fever, constipation, symptoms of meningitis and final coma.

2. In the most frequent cases continuous diarrhea, meteorism, abundant hematuria, hypothermia and final collapse.

Finding myself in presence of a disease with extensive lesions, I directed my bacteriological investigation to these and, with that object under the strictest technical condition, I collected the necessary portions of the viscera, such as blood from the heart, sanguineous urine, biliary and intestinal liquids, as well as portions of the mesenteric glands. I have examined with the greatest care the first blood, the urine and the bile, in all of which I have found more or less microbes, but all morphologically similar. The red globules of the blood were preserved intact. From this moment I added a bacteriuria study to that of the symptoms.

These first labors were followed by the isolation of the microbes which were found. Amongst the means which bacteriology places at our disposal for this purpose I selected those of a mechanical order, and preferred the dissemination in gelatine.

Twenty-four and forty-eight hours afterward, with the assistance of a hand lense of slight power, I was able to observe some small, white, brilliant spots, of very small size. But as this was the commencement of the development of the colonies, I postponed the morphological study to the fourth and fifth day, by which time the whole of the colonies reached their greatest development, but some of them had undergone a change of color.

After an extremely patient work of selection, I was enabled to transfer the colonies to nutrition broths and other solid mediums, such as jelly and potatoes. Forty-eight hours afterward I was able to examine the preparations of the cultures in the broth and in the solid mediums. Those in broth allowed me to observe the mobility of the microbes, whilst the dry and colored preparations served me to study their form and dimensions.

I made use of basic aniline, such as methyl blue, gentian violet and fuchsin in hydro-alcoholic solutions. Later on I preferred to use *fénicated* solutions, that in their character of mordents have the property of preserving their coloring power for a longer time, but always taking care to employ them in a diluted form in order to avoid the difficulties which might be caused by their concentration in investigations that were undertaken for the first time.

These solutions were Ziehl's red, Nicolle's tionine, and Kuhne's methyl blue. To this group I added the Graham reagent and the Nicolle and Morax stain, the latter being necessary to render the organs of movement visible.

The writers on human medical pathology and microbiological technique agree in admitting that no case of spontaneous typhoid fever has been observed in cattle. The bacteriologists and pathologists who have most earnestly dedicated themselves to the study of pathogeny of this disease in man deplore this fact, and live in the hope that the study and progress of comparative pathology will throw a light on this subject and advance the knowledge that up to the present we have of this disease.

From the first studies that I made of cultures in peptonized gelatine from the liquids and portions of the lesions above mentioned, which were taken immediately after the death of the animals, I was able to observe different colonies, of which some were very small but numer-

ous, whilst others were of larger dimensions. Neither of the two liquefied with gelatine.

When I came to examine these colonies forty-eight hours and four or five days after, with a glass of small power, I found them presenting a slightly bluish-white color, others of a full blue color, some with a regular edge and others with irregular edge. Amongst the former the discoid form is the commonest, and after that a finely radiated form, with a regular circumference at the beginning which later on becomes irregular.

In order to proceed methodically, we will give the small colonies the number one and the large ones the number two.

We will now continue with the small colonies, in which under different lights we can see transparent filaments on their surface that slowly hide the radiation of the colonies. I have obtained this delicate form in the blood taken from the heart, the kidney and the urine. Looked at under a microscope of approximately thirty diameters and reflected light, which must be graduated by the mirror in the microscope, they are observed to be transparent in their circumference and translucent in the center, full of rough points, brilliant throughout, and under the light showing the classic and fantastic forms of icebergs. This first form changes in subsequent cultures, presenting an indented circumference. The discoid form is very different, and its dimensions reach a diameter of $1\frac{1}{2}$ to 2 millimetres.

These colonies do not give out any bad odor on the gelatine plates, neither do they change their color from a slightly bluish white. A little knowledge of the microscopic appearance of these colonies is absolutely necessary to avoid mistakes.

The colonies which are numbered two, and that were observed at the same time as the others, present a variable form and appearance. They are transparent and translucent on the surface; some have a regular edge and others irregular. Some are blue and iridescent, whilst others are white and with regular edges. Within a period of four to five days they reached their greatest dimensions. Examined under the microscope, over a transparency, they present a broken surface full of brilliant points, transparent, and with the appearance of ice.

From the fourth to the tenth day they acquire a diameter of twelve to sixteen millimetres, with cut and brilliant edges; whilst in many cases they are shaped and can be easily compared to vine leaves or congealed water.

These colonies finally assume a yellowish color, and give out a fecal smell.

The preparations of these colonies present a short bacillus with rounded ends, either isolated or with one or more connected; some have formed filaments by the lengthening of the primitive cell and the union of cells amongst themselves.

The microbe has a dimension of 2 to 4 microns in length by 5 to 8-tenths of a micron in thickness. The number of the flagellas has been 8 to 9.

For purposes of coloring, I preferably made use of fenicated fuchsin by Ziehl. With this matter I was able to see some microbes with vacuole or colorless spaces. The Graham reagent produced the discoloration, that is to say, they did not take that reagent.

In my study of the microbes of the larger colonies, that are marked with number two, I followed the same order as in those numbered one, as the two microbes have points of resemblance. Microbe number two has mobility, which is sometimes slow but generally has acted as in the other.

The bacillus appears both shorter and thinner, has rounded extremities, and measures two to four microns in length by seven-tenths to a full micron in thickness.

Morphologically, it is really difficult to tell the difference between the bacteria.

The number of projecting threads in the microbe number two have been as many as nine.

From this study we obtain three different data, which are a fecal smell, change of color in the colonies, and smaller number of vibratory threads.

In the meanwhile, I made experimental studies of these microbes, both in laboratory animals as well as in cattle. The results obtained were very clear, and showed that the bacteria are pathogenic. Number one limits the lesions; number two generalizes the congestion and the hemorrhage.

I transferred these bacteria to the lactosed jelly and to the opalescent jelly of Burt's, as well as to sterilized milk and peptonized water. The cultures of bacteria number one, in broth, showed a slight turbidity after four to six hours, and forty-eight hours afterward an abundant, flaky, white deposit, without any pellicle on the surface, and odorless.

The culture of bacteria number two, in broth, are more cautious and abundant, both under the heat of the stove as well as in the atmosphere in the laboratory, and they give a fetid odor.

In jelly, the colonies which run together in the direction of the stria-

tion allow us to observe a notable projection, an undulating stripe that bounds the culture, and that they give out a fetid odor.

The bacteria number one, in striated jelly, are thin on the surface, odorless, and always preserve their white color with a bluish tint.

In cultures on potatoes, thin layers made their appearance along the striations, with a slightly yellowish white color, and these cultures do not give out any bad odor.

The bacteria number two gave an abundant proliferation of the microbe. The confluence of the colonies in the lapse of a few days became prominent, brilliant and glossy, whilst their yellowish color of the first days became dark yellow and greenish. These cultures gave out a fecal odor.

Cultures in Milk. The bacteria number one does not coagulate; bacteria number two produces a rapid and total coagulation in twenty-four hours, whether warm or cold.

Bacteria number one, when sown in lactose broth with carbonate of lime added, does not produce bubbles; the lactose does not ferment in an appreciable manner nor does the saccharose. Bacteria number two exercised a highly fermenting action on lactose.

Bacteria number one, when sown in rose on lactose jelly and Burt's opalescent jelly, produce no change of color in the nutritive medium. Bacteria number two produced a change of color throughout the jelly, which becomes garnet red in twelve to twenty hours. I consider this color of great utility, because besides showing the difference it also shows an extreme degree of activity in the microbe.

Bacteria number one does not produce indol.

Bacteria number two produces gas in peptonized and lactosed water and in glucosed jelly when sown by punctures. No such effect is observed with bacteria number one.

With blood from animals suffering from this disease both experimental and expontaneous I attempted to obtain the Widal reaction, but only obtained the phenomenon of aglutination with bacteria number one, whilst with bacteria number two and the same blood it was not produced.

This study leaves no doubt as to the difference between the two microbes; but each one has shown what are its inherent biological properties, by which it can be identified; number one, with the Eberth bacillus, and number two with the Coli bacillus or Escherich bacillus.

I believe I have here presented a brief extract of the substantial part of the unedited book which I have, and believe that I have obtained the end I desired, which is that of demonstrating to this American Public Health Association that the "Ranilla," the vulgar name that is

given to a disease which attacks cattle in Mexico, is of a microbial character and that its agent, cause, or the unknown point in the problem is a bacterium which has the characteristics and properties of the Eberth bacillus with the aggravating circumstance that it is associated with the colon bacillus.

If, as I hope, the etiology which I present is exact, we can define this disease as follows:

A general disease which evidences the reaction of the organism, which is invaded by the Eberth bacillus and its associate the colon bacillus.

A CONSIDERATION OF SOME OF THE PROBLEMS AND DIFFICULTIES OF BACTERIOLOGICAL DIAGNOSIS.

By BURT RANSOM RICKARDS, S. B.,

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Within the last few years, the scope and amount of diagnostic work in public health laboratories has increased immensely, the increase in scope being due largely to the results of research, the increase in amount to the growing familiarity and confidence in the work of the laboratory itself. This increase in work has naturally multiplied the problems and difficulties to be overcome, and it is with these that this paper has to deal. While the writer fears that he may be accused of dealing in commonplaces, yet it would seem as if a discussion of the points involved might be of value.

It is of course a matter of prime importance that the executive side of the work be so handled that the whole shall run like a well regulated machine not subject to ready disturbance, and quickly adjustable to sudden fluctuations in the numbers and kinds of specimens received. To this end, simple, rapid and exact methods are necessary. Accuracy and promptness are two very essential characteristics of a diagnostic laboratory. Reports must be returned at the earliest possible moment consistent with accuracy, for if a laboratory, perfect on the technical side, has an appreciable percentage of specimens lost, delayed or otherwise poorly handled from an executive standpoint, that laboratory loses greatly in practical efficiency and prestige. Practically all executive details will of necessity be omitted here, however, in order to give time for a fuller discussion of technical matters.

It is the intention of the writer to consider in turn each disease commonly diagnosed bacteriologically in public health laboratories, first, in relation to any special points connected with the preparation of the specimen submitted; secondly, in regard to those problems which have to do with accuracy in diagnosis, and thirdly, with reference to results and their relation to the clinical aspect of the case.

DIPHTHERIA.

(1) Since it is the custom in most places to send out serum tubes in diphtheria outfits, one great problem is to keep the serum in good condition until used. The proper amount of moisture may be retained

for a long time by the use of corks stoppers wrapped in non-absorbent cotton, but the water of condensation must be emptied out of the tubes before sending out the outfits, else contamination is likely to result. Despite all precautions, one is apt to receive a small proportion of dry or contaminated tubes. Such cases are reported by us as "no growths" and fresh specimens requested.

Danger of mixing specimens can be practically eliminated in this as well as in other examinations by keeping the different parts of the outfit together until the report is made. Considerable time can be saved by the employment of long slides about 9 x 2 inches divided into sections with a glass writing pencil, each section being used for a smear with the patient's name written above the smear.

(2) In making a diagnosis of diphtheria, what must the bacteriologist take into account? As this diagnosis is usually made on morphology alone, he must first decide the question of types. Since Westbrook's excellent work along these lines, this matter has been considerably simplified. A culture is considered positive for diphtheria when certain of the granular forms (known as A, C or D types) are recognized. The presence of any of the other accepted types belonging to the diphtheroid group puts that culture under suspicion, but a positive report should not be rendered unless one or more of the above mentioned significant types are present. It is our practice, if only the suspicious forms are present, to report as atypical and ask for a second culture. As has been pointed out by Dr. Hill and the writer in a previous paper,¹ the diphtheria bacillus is the only one of a fairly large number of species examined which snaps in dividing. It is therefore often an assistance in forming an opinion to note the relative position of organisms which evidently recently divided.

The second and greater difficulty is to decide whether the organisms under the microscope are A's, C's, or D's. One member of the subtilis group, after growing on serum, is morphologically practically indistinguishable to the unpracticed eye from the C or D types. On close examination, certain differences are apparent. The lightly stained portion of the rod is practically of the same diameter as the granules and the granules themselves are likely to be less symmetrical. Sometimes also more than three granules are apparent in a rod. This organism, when isolated and inoculated on agar slants, sometimes gives the characteristic wrinkled growth of the subtilis group and is also morphologically characteristic of that group.

Other forms, morphologically like diphtheria, are sometimes found in

¹ Am. Pub. Health Assn. Report, Vol. XXVIII, page 479.

urethral discharges. This fact would of course be of significance only in cultures from the genitals.

The presence of *B. xerosis* and *B. Moffman* in eye secretions and their relation to *B. diphtheriae* must also be taken into account. This part of the subject has been too thoroughly covered by Denny², and others to be discussed here.

(3) A correct laboratory diagnosis, which at the same time would be contrary to the apparent facts of the case, will be returned (1st) in positive cases where the physician, in taking the culture, fails to touch the infected area. This may arise (a) in the case of very young children from the difficulty in inserting the swab into the mouth and in reaching the area desired; (b) in laryngeal cases, from the difficulty in reaching the infected area; (c) in tonsillar infection, from the disappearance of the Klebs-Loeffler organisms from the surface of the tonsils and the difficulty in getting into the infected crypts; (2nd) when the diphtheria bacilli are prevented from developing by the antagonism or rapid growth of some other organism. It has been particularly noticed that if cultures are incubated much over 15 hours, the proportion of diphtheria bacilli to other organisms is perceptibly diminished; (3rd) when the bacteriological diagnosis is positive, the patient being well or only slightly sick. The question of diphtheria bacilli in well persons, having been thoroughly covered in a report of a committee of the Massachusetts Association of Boards of Health, will not be discussed here. A well person carrying virulent diphtheria bacilli is probably more dangerous to the community than a very sick patient; (in this city, virulence tests are made by inoculating guinea pigs with pure cultures of the diphtheria bacillus isolated from the routine culture in all cases requested where there is any question of the virulence of the organism); (4th) through carelessness in taking the culture; (5th) in some cases where an antiseptic gargle has been used shortly before the taking of the culture. The laboratory is of course not responsible for the apparent discrepancy under any of these possibilities.

TUBERCULOSIS.

(1) A small amount of 5 per cent. carbolic acid sent out in the sputum bottle preserves the specimen and minimizes the danger of subsequent handling the specimen.

In the preparation of comparatively large numbers of sputum specimens for examination, the use of coverglasses or of small slides leads to considerable loss of time. A special apparatus and method for stain-

² Journ. Med. Research, Vol. 9, page 117.

ing large numbers of sputum specimens at one time was devised by the writer some years ago³. A long flat water bath, with the steam outlet in the extreme rear corner, has been found of considerable advantage in smearing specimens. By laying the slide on the top of the bath and keeping the bath at the boiling temperature, even mucous specimens smear smoothly and evenly. Urines are fixed by adding alcohol to the smear while the slide is still hot enough to cause the alcohol to boil.

If sputum specimens be stained by the Ziehl-Neelson method, care being taken to decolorize in acid alcohol containing not over 5 per cent HCl until the specimen is no longer red when held to the light, there is practically no danger of reporting a negative case positive.

(2) While the possible presence of other acid-fast bacilli must always be borne in mind in examining suspected tubercular specimens, it is only in the examination of urine or in specimens taken from skin lesions that a serious question is likely to arise.

In examining urine for tubercle bacilli, the smegma bacillus must be taken into consideration. Morphologically, smegma is usually shorter than the tubercle bacillus, but like it, it strains with some difficulty and resists decolorization with strong mineral acids. Gorham and other authorities state that it decolorizes readily with alcohol. It is for this reasons that the acid alcohol decolorizer is advised. Czaplewski states that from culture, it resists decolorization both with alcohol and acids.

It is hardly probable that an experienced observer would mistake smegma for the tubercle bacillus. In all cases where urine is submitted, one should resort to guinea pig inoculation, smegma bacilli being non-pathogenic to animals.

In skin lesions the only other organism which one would be likely to confuse with the *bacillus tuberculosis* is the *bacillus leprae*. Here the characteristic grouping of the bacillus of leprosy would help one. As the *bacillus leprae* is non-pathogenic to animals, it is always safer to resort to guinea pig inoculation.

Various other acid-fast bacilli, frequently found in milk, butter and on hay, would be hardly likely to be present in sputum specimens. Moreover, it is undoubtedly true that nearly all such organisms are decolorized by acid-alcohol. In practice our positive tubercle reports have never been contested.

3. A positive report should never be rendered on a single organism. Several at least should be found. A negative report on a single sample of sputum means little, as a sample may consist largely of saliva. Sev-

³ Journ. Med. Sciences, Vol. V, page 391.

eral specimens at least should be submitted. Even then an incipient case in which little or no breaking down of the lung tissue has occurred will probably show no tubercle bacilli. The best way is to have submitted at intervals specimens collected in the early morning. Repeated negatives are fairly though never absolutely conclusive.

TYPHOID, PARATYPHOID, ETC.

(1) The writer has found the small hard rubber rings, cemented to ordinary small slides by microscopic cement of far greater convenience for hanging drop preparations than the ordinary hollow ground slides. A broth culture made from an agar culture about a month old, the broth culture being incubated at 37° C. for 24 hours has usually given the best results. The problem of accurate dilution is a serious one. The only way to obtain an absolutely accurate dilution is to have the dried blood submitted on a piece of unglazed paper of known weight or on foil from which the blood can be flaked off and the weight of the blood obtained, allowance being made for the difference between dry and wet blood⁴ and then the proper amount of water added. This procedure is of course practically impossible when much routine work is to be covered. A color comparison scheme is the best makeshift.

(2) In making these agglutination tests for paratyphoid and paracolony, a blood will often cause an agglutination of more than one of these closely related organisms. By diluting still further, one or the other of the agglutinations drop out, leaving only one species agglutinated. The writer believes the prevalence of these allied types has been overrated. Out of 900 bloods tested with these two organisms, but four positive reactions were obtained and this diagnosis was abandoned as a routine procedure though tests are still made on request.

False clumping. This may occur if the bouillon culture is old, but would scarcely be likely to confuse an experienced observer. The familiar "wisp of hay" appearance is seldom present in an accidental grouping. If one or more controls are run with the specimen under examination, a false report can hardly be made. One typhoid culture with which the writer has had experience clumped in a fairly typical manner with plain water. False clumps then are of two types — those already formed in the broth before use and those found after the preparation is made up.

Loss of motility may occur in a negative blood from several reasons. At one time, the writer was greatly troubled by a complete loss of motility occurring in every case almost as soon as the hanging drop was

⁴ According to Westbrook, blood loses 75% of its weight by drying.

prepared. Upon investigation, this was found to be due to the fact that the ring slides were dipped into formaldehyde solution to disinfect them, then being washed in running water. Enough formalin remained behind, even after several hours' time, for the vapor of the same to cause the organisms to become non-motile. At another time, a loss of motility occurring in each hanging drop was found to be due to the practice of using cedar oil to cement the coverglass to the rubber ring. Evidently some volatile substance was present in the oil which affected the organism. Vaseline seems to be the best substance to use as a sealing agent.

(3) If a positive report given on a Widal reaction be questioned by the attending physician, it will usually be found that the case is one of "walking typhoid" or that the patient has had true typhoid at some previous date. So far as the writer's experience goes, no positive reaction has ever been successfully questioned, one or the other of the two possibilities mentioned turning out to be true on investigation.

An atypical result, that is, loss of motility without clumping or clumping with little loss of motility or a reaction incomplete in any way, is of little value. Subsequent results may be positive or negative. Complete loss of motility is not essential when clumping is complete and entirely typical.

It should be stated on every negative typhoid report card that a single negative or atypical Widal reaction means little. It is to be hoped that subsequent discoveries will put agglutination reactions upon a more satisfactory footing.

MALARIA.

The chief difficulties usually experienced in this branch of the work are, first, to obtain good blood smears and, second, to stain them well. Since glass slides were substituted for coverglasses in our malaria outfits, we seem to have obtained a smaller percentage of poor smears. Slides are easier to handle and present a much greater surface area, so that even if a poor smear has been made, there is usually some part thin enough, so that a diagnosis can be made.

There appears to be some difficulty in obtaining uniformly good results where alcoholic eosin is used as a counterstain with methylene blue, since the alcohol has more or less of an effect in decolorizing the blue. Methylene blue alone usually gives good results, as does Wright's modification of Leishman's stain. A good quality of the latter stain, which is very difficult to prepare, can now be obtained on the market.

INFLUENZA.

The diagnosis of this organism presents no special difficulties. Characteristic grouping of morphologically correct organisms in the stained preparation, decolorization by Gram's stain and the characteristic pin-head colonies on agar smeared with blood are sufficient for diagnosis. Animal inoculations are of little value. It may sometimes happen that the observer may detect the probable presence of this organism in sputum specimens stained by the Ziehl-Neelson method. As is well known, the bacillus of influenza sometimes causes symptoms very different from the ordinary clinical signs of the grippe. It has often been found in cases of meningitis, middle ear inflammations and in cases of pneumonia and chronic bronchitis.

GONORRHEA.

One of the chief difficulties in the way of a successful diagnosis of this disease lies in securing a proper specimen. From the male, this is usually an easy matter; from the female, it is next to impossible to secure a good specimen unmixed with vaginal secretions. The average specimen submitted from the female is so mixed with extracellular coccus forms as to make a diagnosis impossible. When a typical intracellular diplococcus is found, which is decolorized by Gram's stain, it has been our custom to report as positive, accompanying the report with a statement that the microscopic diagnosis alone is not good legal proof and that for the latter, a cultivation of the organism on media is essential. This cultivation in itself presents another difficulty as the organism shows little or no growth on most of our common media. Coagulated human or rabbit's blood serum, blood agar and nutrose serum have been recommended; also various mixtures of pleuritic, hydrocele or other effusion with agar. The colonies develop in from 24 to 48 hours as small semi-transparent discs, varying in size and not tending to become confluent.

GONORRHEAL OPHTHALMIA.

The Legislature of the State of Massachusetts, at its last session, made it obligatory on the part of the attending physician or nurse to report to the board of health any case of eye inflammation or unnatural discharge from the eyes occurring within two weeks after birth. In order to meet the situation, the laboratory of the board of health of this city has prepared an outfit to be used in cases of this kind. The outfit, which was devised by Dr. H. W. Hill, consists of two sterilized wire

loops in separate small envelopes, two labelled glass slides and a card to be filled out by the physician and a sheet of directions for taking the smears. The slides are surrounded by a strong rubber band, then enclosed in a tin box and the box also surrounded with a rubber band to prevent breakage. The assembled parts of the outfit are received in a strong manila envelope which can be mailed directly to the laboratory. Two loops are included in each outfit — one for each eye, in order to avoid the chance of carrying infection from one eye to the other.

GLANDERS.

Smears made directly from swabs may give some indication, but are usually of little value. Direct inoculation of the swabs taken from nasal lesions usually result in the growth of moulds.

A satisfactory diagnosis of glanders is sometimes rendered difficult owing to the presence in the specimen submitted of organisms which cause the death of the inoculated guinea pig from peritonitis before the glanders organism has time to develop. In such cases, there is little that can be done except to secure fresh specimens and try again. It is oftentimes of value, where one unsatisfactory result has been obtained to inoculate at least two pigs at a time and to decrease the amount inoculated into each pig by about one-half. As a last resort, subcutaneous inoculations may be substituted for the usual intraperitoneal injections. Pigs dying from peritonitis within forty-eight hours after inoculation should be reported as unsatisfactory, but never as negative, since experiments have shown that pigs inoculated with a mixed water emulsion of some one of the more common pus organisms and *B. mallei* will die in nearly every case before glanders lesions have had time to develop. Inoculated pigs sometimes die of general infection of glanders without showing testicular lesions. For this reason, it is always well to autopsy pigs that die without showing typical lesions, particularly if forty-eight hours or more have elapsed since inoculation.

Smears and cultures on potato should always be made with material from the guinea pig lesions in order to verify the diagnosis. In all cases of atypical testicular lesions, typical but long delayed lesions or lesions in unusual parts of the body, it is best to try a reinoculation with a water emulsion made from the culture, in order to obtain complete legal proof of glanders. The writer has seen cases in which abscesses have developed on the back of the pig or on the leg, after considerable delay and without testicular lesions, which contained typical glanders organisms which when reinoculated into a guinea pig gave typical lesions.

Typical cultures without guinea pig inoculations are of practically no value since Frothingham and others have demonstrated that there are several species which give glander-like growths but which are not *B. mallei*.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.

The recognized cause of this form of meningitis is Weichselbaum's *diplococcus intracellularis meningitidis*. As described by Councilman, Mallory and Wright and others, this organism stains with the ordinary stains, but with considerable irregularity, some organisms being bright while others in the same field may be very pale. There is usually some variation in size, the larger organisms staining imperfectly, often having a bright spot in the centre, the remainder of the cell being scarcely colored. It grows almost invariably in the diplococcus form, having but very slight tendency to chain or form tetrads. It may usually be found within the cell in exudates and secretions, but is occasionally absent in well advanced cases. This organism may usually be made to grow on freshly prepared Loeffler's blood serum, the colonies being white, viscid and shining with smooth, sharply defined outlines tending to become confluent. It will grow on glycerine or blood agar, but grows with considerable difficulty on ordinary agar and in bouillon. Inoculations made directly from the secretions upon agar usually fail to grow. Animals are but slightly susceptible.

EXECUTIVE PROBLEMS RELATING TO ACCURACY OF REPORTING AND PROMPTNESS.

The following methods have been adopted in the Bacteriological Laboratory of the Board of Health of this city:

On request, smears from swabs from suspected cases of diphtheria are made. By this method, it is possible to detect 50 per cent. of those cases examined, which finally yield positive results on incubation. A saving of from 15 to 24 hours is thus effected.

All cultures for diphtheria diagnosis received before noon are incubated and examined at five o'clock. There is usually sufficient growth to make a diagnosis. All cultures are incubated over night.

All cases of negative cultures on which the physician calls the case diphtheria, or on which he indicates membrane on the pharynx or larynx, or when a suspicious looking organism is present in the culture, a second culture is requested by telephone. This is also done when a liquefying organism is present on the serum or if the serum has been allowed to dry to such an extent that no growth develops

after incubating. Positive results on cultures for diagnosis are also telephoned.

Cultures taken after the laboratory has closed for the night may be sent by messenger to the laboratory and dropped through a chute directly into an incubator. Results on such cultures are ready the next morning and a saving of at least 24 hours is usually effected.

Positive, negative and unsatisfactory report cards are distinguished one from the other by having each kind printed in a different color. The clerk is required to check each report card against the original outfit card.

Mixing of outfits is guarded against by keeping the outfit card with the outfit until the diagnosis is made and recorded. By this method, about 100,000 specimens have been examined without a single case of confusion of identity.

In conclusion let it be said that however great be the effort on the part of the laboratory to secure accurate results and prompt reporting of the same, a large part of the value of such a report may be lost to the physician if he fails to put the right interpretation upon the result.

THE COMMUNICABILITY OF CEREBRO-SPINAL MENINGITIS.

By WILLIAM HALLOCK PARK, M. D., AND CHARLES BOLDUAN,
M. D., NEW YORK CITY.

During the past year there has been carried on in the Department of Health Laboratories a bacteriological and clinical study of the means by which cerebro-spinal meningitis is spread. The clinical investigations were carried out by Dr. Bolduan, and the bacteriological ones by Dr. Mary E. Goodwin. The details of the work of Dr. Goodwin will be found in the proceedings of the Laboratory Section. If cerebro spinal meningitis is a communicable disease, there should be distinct evidence of transmission in a sufficient percentage of the cases to indicate the fact. Dr. Bolduan continued to follow the location of outbreaks of disease until 1,500 consecutive cases had been accumulated, and wherever more than one case happened in a family to investigate the conditions personally, so as to get as many facts as possible, with the hope that these would throw light on the degree of communicability which existed. He found that among 1500 cases there were two hundred which occurred in groups of two or more cases. There were, therefore, 112 cases, or over 7 per cent. which occurred in connection with a previous case. Fifty-eight of these groups were carefully investigated. These represented 144 cases as follows:

39 instances with two cases to a house.....	78 cases.
15 instances with two cases to a house.....	45 cases.
2 instances with two cases to a house.....	8 cases.
1 instance with two cases to a house.....	5 cases.
1 instance with two cases to a house.....	8 cases.

As one studies the circumstances under which the secondary cases in these groups occurred, the impression that the disease is communicable becomes very strong. Before touching on the bacteriological findings which support this view, it will be instructive to study ten representative histories. Those selected are the last ten groups investigated and are not more striking than the other forty-eight. The complete report will appear in one of the December issues of the *Medical News*. Group 49.—Mrs. S——, of 501 E. 76th Street, (tenement), had a baby sick with C. S. M. from February 10, 1905. The child died

March 7. Among those who came to express their condolences was Mrs. S——, living on the same floor, who stayed but a few minutes. On March 18 the latter's 13-year old son developed the disease and died two days later. No other contact can be discovered. No other children. Each family occupies three rooms. Interval between cases 11 days.

Group 50.—Mrs. W——, of 871 First Avenue (tenement), had a child die of C. S. M. on February 24, after an illness of three days. On March 17 the nine-months baby of Mrs. J——, the janitress, developed the disease and died in ten days. Mrs. J—— lives two floors below W——, and visits the tenants to collect the rent. Interval between cases 22 days. It may be remarked in passing, that Mrs. W—— lost a child of C. S. M. in March last year, 11 months ago. At that time she lived in this same house. The possibility of Mrs. W——, being one of the exceptional cases in which the meningococci remain in the nasal cavities for a long time must be thought of in this instance.

Group 51.—In 75 Baxter Street an Italian family, B——, living on the fifth floor of a large tenement had a baby aged 8 months sick of C. S. M. Eleven days after the onset the baby's brother, 8 years old, developed the disease and died in two days. On the seventh floor of this tenement lives another Italian family, C——. Their baby, one year old, was taken sick with C. S. M. about three weeks after the B—— boy had died and while the B—— baby was still sick in the house. The C—— baby died in a week. There are other children in both families, and they all play together.

Group 52.—In 13 Little West 12th Street, Mrs. F—— had her four children all stricken with C. S. M. within a few days. All of them were at once sent to St. Mary's Hospital. Two of them died, one March 9, the other March 11. On the death of her two children Mrs. F—— visited a family living on the floor below and cried a great deal as she related her story to Mrs. D——. Five weeks after the last child had been taken to the hospital, and about the same time since Mrs. F——'s visit just mentioned, the D—— baby developed C. S. M. The following day the five year old boy was taken sick, and three days later two more developed the disease. Three of these have died. There is considerable intercourse between the families.

At the time these facts were elicited, four days after the last of Mrs. D——'s children had been sent to the hospital, nasal swabs were taken from both Mr. and Mrs. D——. Both were found to contain great numbers of meningococci.

Group 53.—At 517 W. 46th Street a young man, A——, devel-

oped C. S. M. suddenly after playing ball in Central Park. He was treated at home for four days and then sent to Roosevelt Hospital, where he died in two days. During his stay at home he had been nursed by his mother, Mrs. R——. She developed the disease five days after the boy was removed to the hospital, and died in two days. Interval between cases, five days.

Group 54.— At 428 West 37th Street Kate D—— developed C. S. M. on March 30, and was removed to the hospital the next day. Her brother, 13 months old, was taken sick eleven days after this and died in one day. Intervals between cases, 11 days.

Group 55.— At 158 West 28th Street a boy $2\frac{1}{2}$ years old, the child of a fruit peddler, M——, developed C. S. M. He was sick only one day and died March 29. Five days later two other children were taken sick. One of these has completely recovered, the other is still living, (IV-18) in the hospital. Interval between first and second cases, five days.

A nasal swab taken from Mrs. M—— fourteen days after the children were sent to the hospital showed very many meningococci. Swabs made from the other children and from the convalescent case were negative.

Group 56.— In 86 Horatio Street, Mary M——, aged 6, was taken ill with C. S. M. on Christmas eve. She was sick for about two months and recovered, although deafness resulted. A week after the onset, the girl's aunt, Elizabeth F——, who lived in the same apartment and had nursed the girl, developed the disease and died after an illness of one week. Two weeks after the funeral of the aunt, and while the first case was still in the house, a little baby sister of this first case became ill. She died after an illness of five weeks, during which time she had many convulsions and high fever. (The attending physicians said she died of convulsions due to teething, and that she did not have C. S. M.)

Group 57.— At 131 Thompson Street, a boy, eleven years old, developed C. S. M. and died in 24 hours. Two months after this, two other children living in this apartment, one a brother, A——, aged six, the other a cousin, G——, aged 4, of the first case, became ill. Both died after an illness of three or four days. Interval, two months.

Group 58.— At 515 E. 12th Street, John E——, two years old, was taken sick the beginning of March. Three weeks later while the first case was still alive in the house, his brother, 8 months old, Andrew, developed the disease. Both died about April 7.

The bacteriological findings of Dr. Goodwin in these cases were very striking. Meningococci were found to be abundantly present in

the nasal mucous of more than fifty per cent. of the cases of meningitis examined during the first week of illness, and in 33 per cent. during the second week. In 15 cases examined during the second, third and fourth weeks none were found, but in one case examined on the 67th day of the disease they were present in small numbers. Dr. Goodwin found meningococci in the nasal secretion of five out of forty-nine persons in the tenements, who as near relatives had come into close and constant contact with the sick. These cocci obtained from the nasal mucous are believed to be certainly meningococci, not only because they were tested by all the recognized methods which included cultures, stains and injection into the spinal canal of animals and reactions with specific agglutinating sera, but also because they were compared with the cocci obtained from the spinal fluid of many cases. They were thus shown to be meningococci of the type existing in the epidemic. The full report of the bacteriological investigations will be found, as before stated, in the proceedings of the laboratory section.

The proof that meningococci are the usual existing factor in the development of epidemic cerebro-spinal meningitis and are very frequently the cause of the sporadic cases, has long been established. That these organisms are sometimes present in the nasal mucous of the sick has also been shown. Our investigations directed especially to this point have, we believe, demonstrated that not only occasionally but usually meningococci are present in the nose and mouth secretions of the sick, and in quite a number of those who without taking special precautions care for the sick. It will be asked by some: Why is it that so few develop meningitis if the meningococci are so frequently present in the nasal secretions? The carrying of meningococci to the nostril of a healthy person does not necessarily excite an infection, nor is the infection of the nasal mucous membrane necessarily followed by the passage of the meningococci to the meninges and the setting up of meningitis. Thus, for instance, we know that the transfer of pneumococci from a case of lobar pneumonia to a healthy throat and their growth there is not usually followed by the development of pneumonia, unless some marked exposure to cold and wet has transpired. The implantation of diphtheria bacilli in a healthy throat and their development there is on the other hand usually, but not always, followed by the development of diphtheria. It is probable that the meningococci hold a position midway between these two, and we have reason to believe that infection of the nasal mucous membrane in young children is frequently followed, and in adults sometimes followed by meningitis. The very course of the present, and of most

previous, epidemics points to the respiratory mucous membranes playing a part. In the winter and early spring of 1904 this present epidemic developed, and in May began to decline; during the summer and fall the cases almost disappeared, but with the winter of 1905 they again multiplied, so that more than 100 deaths occurred weekly. With the coming of warm weather the disease has again greatly diminished. The bacteriological and clinical results obtained in this investigation at the Research Laboratory have agreed with those made by the members of the Meningitis Commission. The Board of Health has, therefore, decided to treat cerebro-spinal meningitis as a communicable disease, and to consider that the organisms are most usually transmitted from the nasal or throat secretions of one person to another. The cases are, therefore, isolated, and the nasal and mouth discharges treated as in diphtheria. As those in close contact are liable to become carriers of infection or possibly may contract the disease they should be careful not to use handkerchiefs or towels used by the sick, and should keep their hands free from infection, or sterilize them when soiled.

As by far the greatest amount of nasal infection is during the first two weeks, isolation during that period is more necessary than at later periods. Those who are in close contact with the sick should be either isolated or at least instructed as to the possible danger of their intercourse with others unless they observe great care.

Meningococci are rarely found except in those who have been in close contact with infected persons.

PREVENTION OF DAMPNESS IN HOUSES.

BY CRISTINO F. COWAN, M. E., S. E.,

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One of the most vital requirements of a dwelling-house is that it should be dry. To be dry it must be so constructed that it will resist all attempts of a variable climate to make it damp. The destruction of pictures, carpets and furniture is only a small item of the ill effects that generally accompany the occupation of a damp dwelling; for injury to furniture can never be regarded so seriously as injury to health, and the premature shortening of life. Pneumonia, rheumatic fever, neuralgia and phthisis are a few of the more dreaded diseases caused by dampness in houses; and, in addition, there is always present a greater liability to the common "cold," with its possibilities of leading to more serious complaints.

This being so, it is of general interest to know the methods by which we can prevent the entrance of this most insidious enemy — damp — into our houses.

We all know that the ground-water level is of great importance to the well-being of man. It has been definitely ascertained that a persistently low-water level (about 15 feet from the surface) is healthy, the mortality being the lowest in such places; a persistently high ground-water level (about 5 feet from the surface) is unhealthy; and a fluctuating level, varying from high to low as the one we have in the city of Havana, is the most unhealthy, and is a continuous menace to life and health.

A damp soil, viz., a soil wherein the ground-moisture is very great and persistent, has been found inimical to the health of the inhabitants, favoring the development of various diseases by the direct effect of the dampness itself, and by the greater proneness of damp ground to become contaminated with various pathogenic bacteria and organisms which may be drawn into the dwellings by the movements of the ground-air.

The requisite characteristics of a healthy site for dwellings are: a dry, porous, permeable soil; a low and non-fluctuating ground-water level, and a soil retaining very little dampness and free from organic impurities. Exposure to sunlight, and free circulation of air, are also requisite.

According to Parkes, the soils in the order of their fitness for building purposes are as follows: (1) Primitive rock; (2) gravel with pervious soil; (3) sandstone; (4) limestone and made soil. Marshy lands, clays and marls are not to be considered as soil fit for human habitation.

Among the methods taught by sanitary science to improve a defective soil and to prepare a healthy site, besides the subject of sub-soil drainage which is very important, there is the proper construction of the house.

An eminent professor told his audience that they ought to thank the jerry-builder for making houses into which fresh air could always gain an entrance, no matter how much the inmates tried to exclude it by the use of draught preventers. But when suggesting that our thanks were due to the jerry-builder, the professor forgot to mention that we could not feel thankful for the intrusion of the damp.

Apart from bad design, bad work and inferior materials are responsible for dampness. Like the modern besieger, damp attacks our castles from above, below, and sideways. If the roof has a weak place, our enemy finds it; if our walls are not what they should be, he knows it before we do; and if the upward path, from the soil on which the house stands, be not obstructed — well, that way in is as good as any.

To prevent the damp from taking possession of our walls, by entering through the brickwork in contact with the ground, a damp-proof course must be inserted at a level of from three to six inches above ground line. This damp-proof course may consist of sheet lead, asphalt, sheet bitumen, a double course of slates in cement, or stone-ware slabs specially made for the purpose. In the majority of the houses the damp-proof course is only a few inches above ground line, as it is necessary to place it beneath the level of the ground floor. Mr. Rufus E. Marsden, an English expert in house sanitation, was recently consulted in a case where a previously dry house became damp, and it was thought that perhaps the excessive rains in the early part of the year had been the sole cause; but on inspection he found that the surrounding ground had been made up for garden purposes, so that the level of the earth was above the damp-proof course, and this had led to the mischief. We may suggest an economical and yet satisfactory method of remedying this state of affairs, where it exists. Dig the earth away from the walls of the house, and run a Portland cement plinth along the wall, extending from a few inches above ground level, to a short distance below the horizontal damp-proof course.

In very wet subsoil the horizontal damp-proof course alone is not

sufficient to keep the damp out of the dwelling. Especially is this true when the lowest floor is below the outside ground level. The best method of constructing a house in a damp situation is by building an open area all around the dwelling. Another method is to build the walls in two portions, with a cavity between. This cavity should be drained and ventilated, but at the best it is not so good from many points of view as the open area. An economical way of keeping the wall dry is to render that surface of it which is in contact with the ground, with Portland cement or asphalt, the latter being preferable; or the cavity between the two walls can be made about one inch wide, and filled in with some damp-proof material, such as White's hygeian rock, or asphalt.

A regulation properly imposed in London is, that the sites of all buildings shall be covered with six inches of good concrete. But as concrete alone is not impervious, it is necessary in very damp situations, to finish the top surface with either neat Portland cement or asphalt. Wherever it can be applied, asphalt renders a wall impenetrable to moisture. Callender's sheet bitumen can be used with like effect.

To prevent damp from entering through the walls of a house, it is necessary that they be constructed of thoroughly sound materials; porous bricks and weak mortar readily absorb any moisture they come in contact with. The joints of the brickwork should receive attention, the best joint being that known as a "struck" or "weathered" joint. Another form of joint very popular with a certain class of builders, is that known as "tuck pointing." This is usually adopted when the quality of the work requires disguising, because the whole surface is either rubbed over with a piece of soft brick of good color, or a colored wash is smeared over it; then a small white band of lime putty is stuck on to the center of the hidden joint. This small band has the appearance of a neat white joint, and imitates one indication of good work. The only time when tuck pointing can be recommended, is when the bricks have crumbled away at their edges, leaving very ragged joints.

In very exposed situations, where driving rains are prevalent, hollow walls are built. They consist of two walls, with a cavity between them, the two walls being tied together with stoneware or iron ties. The thin wall faces the weather, and the cavity prevents the inner wall from getting damp. In cavity walls, the cavity helps to preserve a more equable temperature in the interior of the house, besides preventing dampness.

To prevent walls built in one piece, as those which characterize

Spanish architecture, from becoming damp, after the house has been built some time, several methods may be adopted. A preparation known as "Fluate" has proven to be a real preservative, and makes the surface to which it is applied damp-proof. The liquid can be directly applied to stonework, while for brickwork it is necessary only to use a dressing of "Avant Fluate," and then a dressing of "Fluate of Magnesia." There are patent silicate paints on the market for the same use; but two coats of Portland cement wash will form an effective cure of damp walls.

Other remedies are: the application of three coats of boiled linseed oil; paraffin paint, prepared by dissolving one part of paraffin in two to three parts of coal-tar oil, at a moderate heat, oil being mixed with it to prevent it from quite congealing when cool; and hanging tiles, or a rendering of Portland cement stucco. The tiles used should be well burnt, so that the exposed surfaces are impervious to moisture; they can either be fixed by nailing direct to the brickwork, or battens may first be nailed on. Slates may be used instead of tiles. To keep the face of the wall as free from wet as possible, all window sills should stand out beyond the face of the wall, and have a small groove, known as a "throating," run along their projecting undersurface.

Cornices and string courses should project and be throated in a similar way; and the joints in rainwater pipes should be secure.

The slates and tiles on roof should be of good quality, and so laid that the rain is quickly conducted into the gutters, which must be kept clean. It should be borne in mind that a straight roof can be more easily made and kept water-tight than can a roof cut up into numerous surfaces and angles.

As regards the windows, the ordinary "guillotine" sash that slides up and down in two pieces is most easily made water-tight. The bottom part of the best form of such a sash consist of a window board fixed to the lower end of the frame, so as to permit the lower sash to be opened for ventilation purposes without causing a draught. When the lower sash is raised to the top of the window board, fresh air is admitted between the two sashes, thus giving ventilation, even in windy weather, without draught.

The joints between the bottoms of doors and the door sills may admit the rain in exposed situations. To remedy this, a weather board can be fixed onto the lower part of the door, so that any water running down the face of the door is conducted away from the joint between door and sill.

A little attention to details such as those mentioned will do much to make a house comfortable. In conclusion it must be pointed out

that all gutters and water pipes should be periodically attended to, so that they may be kept quite free from obstruction. Besides the prompt removal of all water from the surface and subsoil, as previously stated, which is accomplished by efficient drainage, all garbage, street sweepings, solid kitchen and factory waste, decaying vegetable matter, and other dry refuse should be promptly collected and removed, and all excrementitious, or human waste, and liquid refuse should be removed by an adequate system of sewerage. By such means, the putrefying matter, stagnant water, and dampness, which not only generate disease germs, but also make their continued existence possible, are effectually removed. The soil is thus rendered dry and wholesome, and the air is purified.

Finally, I wish to state — though I regret to say it — that notwithstanding the great work on sanitation so intelligently executed by the sanitary authorities in Havana, we have yet pending our new proposed sewerage system which promises to do away with the evils so long perpetuated. It is for the social and national prosperity of Cuba that we, her sons, should fight for her enjoyment of the common blessings of life.

THE PRESERVATION OF FOOD WITH ANTISEPTICS.

By PROFESSOR JOSE D. MORALES, MEXICO CITY, MEXICO.

One of the most important matters and one which will always pre-occupy hygienists is that which has reference to the quality of foods destined for public consumption.

The Mexican Sanitary Code foreseeing this necessity, contains a chapter of regulations for eatables and beverages.

In Article No. 118 the Code provides that eatables and drinks designed for sale must be pure, healthy and in a perfect state of preservation besides always conforming to the law as regards composition and nature of the denomination at which they are sold.

Correlatively to that article number 121 defines *adulteration*, which is the object of obstinate prosecution on the part of the authorities, in the following way: A food or drink is considered adulterated (1) if it contains one or several substances alien to its natural composition, either known or accepted, or (2) if there have been withdrawn one or several of its components, partially or totally, or (3) if it does not correspond by its nature, composition or quality to the name by which it is sold.

It must be understood that according to the regulations just quoted there can not be legally sold food other than of good quality.

There is nevertheless a point subject constantly to study and controversy of a scientific order, and which gives rise to a multitude of proceedings which speculators are willing to harbour and which refer to the preservation of foods by antiseptic substance. Regarding this matter I wish to draw the attention of this assembly by presenting to it a series of conclusions which, being approved, constitute the foundation of the legal decisions which, it is recommended, should be dictated by the authorities of the different countries represented here, to make uniform the exigencies which they must hold with reference to the preservation of food by adding substances alien to its constitution.

The causes of the alteration of foods are well known, being the natural result of their chemical constitution with regard to the medium in which they find themselves, which unfit them for fulfilment of their object.

These alterations constitute the fermentations. To preserve a food is therefore to place the same in a condition which renders impossible the fermentation mentioned.

A food is preserved by sterilization, which means hindering life of germs or ferments in its proper substances.

The preservation of substances is therefore contrived by the proceedings which bacteriology teaches us to secure sterilization, and according as these proceedings modify or not their nature, they must be accepted or refused.

The application of heat gives the result of the well known means of preservation of the system Pasteur. Lowness of temperature, uninterrupted, constitutes another medium of conservation, the most known and easiest of use.

The mixture of condiments which prevent fermentation, working after the manner of the antiseptics, constitutes another medium for preservation which can be recommended, especially when the nature of the substances employed appears at first sight and cannot in any case conceal the state of the food thus preserved.

Salt, sugar, vinegar, alcohol constitute the base of these condiments for preservation which cannot be considered noxious.

This is not the same with the mixture of some substances of highly energetic antiseptic action.

The preservation by these means must preoccupy hygienists and it is important to call the attention of the governments to the fact that the employment of these substances must be abolished.

Formol or formaldehyde, acid benzoic, salicylic, sulfites, bi-sulfites and hiposulfites, boric acid, boratium of soda and silicate of soda as also fluoruros and fluoborates, are products dangerous to health and which are recommended against the opinions of hygienists who, with reason, proscribe all these additions.

The foods conserved with these products are less assimilable and their digestion slower and incomplete. Some of these foods, as for instance, milk used for delicate persons, the sick and children, certainly increase the mortality.

Studies of great importance have been made with other products, such as sulfite of soda and all the remaining compounds which owe their properties to sulfurous acid.

The fatty degeneration of the parenchyma of the kidneys is due to the continued use of this product, as shown by Dr. Kionka, who has since 1896 experimented with these substances on a grand scale on dogs.

Boric acid and the borates held toxicity well established by the studies successfully established by Mr. Chevallier. Numerous experiments have proved their disastrous influence exercised on the action of the kidneys and digestion as well as on the nervous system. Nephritis has been the result of continued ingestion of these salts, and facts of this

nature compel us to conclude that food products containing boric acid, are capable of producing grave toxic accidents when absorbed continuously.

No antiseptic substance of the nature indicated must be mixed with the products introduced as food. This prohibition must be absolute, or at least, when use is made of antiseptics it may only be on the cover or the surface of the foods in order to protect them against insects, etc., and to diminish the dangers of contaminations which they are naturally exposed to. In this case the part so damaged should be eliminated by decortication or perfect washing before consumption. The exception proposed is very convenient for all these food products for which a special cover or costra is formed to ensure its conservation, as is done with various kinds of cheese, ham, etc.

With regard to what has been shown it would be convenient to declare as the only methods for the conservation of food the following:

(1) The Pasteurizing recognized and applied as the principal method of preservation.

(2) Refrigeration, being a most useful proceeding to insure a good state of the articles for alimentation during their consumption, or say for a relatively short time.

(3) The addition of condiments which, although they act up to a certain point as antiseptics, are without the deleterious results of antiseptics and besides are substances whose presence is revealed by our senses, as for instance, salt, sugar, vinegar and distilled alcohol.

(4) Ozone in very small proportions in order to prevent the development of *pathogenic germs*. The substance offers the advantage of disappearing at the same time by the fact of chemical transformations, self-imposed, and constitutes a good medium of preservation of many foods, but is applicable most specially for sanitation and improvement of potable waters.

(5) The addition of the antiseptics which do not mix with the substance of the foods and may be separated from them entirely on consumption in such a manner that they do not change their constitution, yield also a good medium of conservation on condition that the separation of the portion damaged by the antiseptic be recommended.

(6) The mixture of the following substances with foods is to be prohibited: Boric acid, borates, acids sulphurous, sulphites, hyposulphites, acid benzoic and benzoates, acid salicylic, acid fluoridrico, fluoruros, and fluoborates.



OFFICIAL REPORT OF THE PROCEEDINGS OF THE THIRTY-THIRD ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

MONDAY, SEPTEMBER 25, 1905.

The Laboratory Section held its meetings at the Fenway, under the Chairmanship of Dr. Wm. H. Park, of New York.

TUESDAY, SEPTEMBER 26, 1905 — FIRST DAY.

MORNING SESSION.

The Association met at the Young Men's Christian Association Hall, and was called to order at 10 A. M. by the President, Dr. F. F. Westbrook, of Minneapolis, Minnesota.

THE PRESIDENT.— The first order of business is the reading of the minutes of the last meeting.

DR. HENRY D. HOLTON, of Vermont.— Inasmuch, Mr. President, as these minutes have been printed and probably read by all of the members, I move that the reading of them be dispensed with. Seconded by Dr. Montizambert, and carried.

THE PRESIDENT.— We will now listen to a report of the Executive Committee by the Secretary.

THE SECRETARY.— The Executive Committee has only to report this morning a list of applicants for membership which has been acted upon by the Executive Committee favorably and recommended to the Association for election.

The Secretary then read a list of the applications for membership which were recommended by the Executive Committee to the Association for election, and, on motion of Dr. John Guiteras, the Secretary was instructed to cast the unanimous ballot of the Association for the names mentioned, which he did, and they were declared duly elected.

THE PRESIDENT.— We will now listen to a report by the Chairman of the Local Committee of Arrangements, Dr. Durgin, of Boston.

REPORT OF THE LOCAL COMMITTEE OF ARRANGEMENTS.

DR. SAMUEL H. DURGIN, of Boston.— Your Local Committee wishes to announce, that on Wednesday morning we had an invitation from

the New York, New Haven and Hartford Railroad to meet at the South Terminal Station, there to be taken by the Superintendent, Mr. Sanburn, by train to South Boston, only a few minutes' ride, and there to see a new improved process of cleaning cars, especially the upholstery. I am told that it is well worth seeing; that there is nothing equal to it in this country. It is proposed, too, that you should see something of this grand railroad terminal, the largest station in the world, before going to South Boston, and which will take but a few minutes.

The Massachusetts Institute of Technology has expressed a desire to render every service and to tender every courtesy to the members of the American Public Health Association.

The members of the Association are cordially invited to inspect the laboratories of the department of Chemistry of the Institute, and guides will be provided at any time between 2 and 4 P. M. The Department will be glad to place slides or apparatus for purposes of demonstration at the disposal of members.

The Biological Department desires to extend to the members the use of its rooms and apparatus at any time during the meetings. It will be pleased to supply microscopes and bacteriological apparatus for demonstration purposes. The laboratories will be open for inspection from 9 to 4 on any day during the meeting.

Members and friends are cordially invited to inspect the sanitary research laboratory and sewage experiment station at 786 Albany Street.

The Bacteriological Laboratory of the Boston Board of Health will be open for inspection with demonstrations of routine methods, special apparatus, etc., on the afternoon of September 27th, or such day as any of you may choose to go. Individuals and small parties will be welcome at any time.

The Milk Inspection Laboratory has also extended an invitation to the members to visit it.

The members of the staff of the Boston Bio-Chemical Laboratory invite the members of the Association to visit that laboratory, and offers the use of any of its appliances to visiting members for purposes of demonstration.

The Walker-Gordon Laboratory will be pleased to have the members of the Association visit its farm at Charles River at any time during the week, with the exception of Wednesday afternoon.

The State Laboratories and the Lawrence Experiment Station will be open to members during the week.

Tuesday evening, after the general meeting, a reception to the Pres-

ident of the Association will be held in the parlors of the Hotel Brunswick.

Tuesday evening, at 8 P. M., there will be a reception at the Hotel Brunswick by the citizens of Boston.

Friday afternoon, at 12:30, there will be a trolley ride to Concord and Lexington; also a drive through Chestnut Hill and Brookline at 1:30 P. M.

Your committee has nothing further to report at this time.

THE PRESIDENT.— The first paper to be read this morning is one by Mr. C.-E. A. Winslow and Mr. Earle B. Phelps, of Boston, entitled "Experiments on the Purification of Boston Sewage, with an Historical Review of the Sewage Disposal Problem." (See paper, p. 16.)

Mr. Marshall O. Leighton, U. S. Geological Survey, read a paper entitled "Industrial Wastes and Their Sanitary Significance," (See paper, p. 29.)

A paper entitled "Disposal of Municipal Rubbish," by Colonel W. F. Morse, of New York, was read by title, on motion of Dr. Holton, in the absence of the author. (See paper, p. 41.)

Mr. George A. Soper, of New York, read a paper entitled "The Pollution of Shell-Fish." (See paper, p. 54.)

DISCUSSION.

These papers were discussed jointly.

The discussion was opened by Mr. H. W. Clark, of Boston, who said:

MR. CHAIRMAN AND GENTLEMEN:— I really can say but little on these three subjects although they are of great importance.

In regard to Mr. Leighton's paper, I am glad that subject has been brought up here and is to be discussed at this meeting. In a state like Massachusetts, where the manufacturing industries are very large and our streams comparatively small, the pollution of these streams by industrial wastes is of a good deal of importance from a sanitary point of view. As Mr. Leighton has said, we have during the past ten years made some investigations in regard to these wastes and methods for their purification. The most important wastes, the largest volume of wastes coming to our streams, come from the cleansing of wool, from paper mills, from tanneries, from silk mills and woolen mills. Some of these wastes are easily purified while others are very difficult of purification. We have, as Mr. Leighton states, attacked this question from the outside rather than from within the mills. Such wastes as come from tanneries in this state are easily purified, although some of them contain germicides used in preserving the hides or re-

moving hair, or used in some process of tanning. All of these wastes that we have run across and experimented with, we have found can be purified by the ordinary method of sewage purification, that is, by sand filters, etc.

The paper mill wastes present quite a different problem. The volume from the tanneries is, of course, large but that from the paper mills is much larger. Some of the paper mills in the state turn out from one million to two million gallons of waste each day, and these wastes contain many times as much organic matter as ordinary domestic sewage. Some of the wastes can be treated at high rates as the matter is largely held in suspension, and will collect and be taken out by sand or coke filters or strainers.

From other paper mills the waste is of a different character in that it contains a large amount of chemicals. With wastes like these last, we have to study the matter from a chemical point of view, that is, purification by means of chemicals before straining or filtration.

The wool liquors are very large in volume, some of our industries turning out from one million to several million gallons of this waste each day. Some of them use a hundred gallons of water for each pound of wool scoured. We have studied the disposal of these wool wastes also from the outside; that is, we have not studied the subject, to any great extent at least, with a view of obtaining by-products. One reason why we have not done this is that at Lawrence, where the principal studies have been made by the Board, various large mills and wool-scouring concerns have studied the by-product question and have spent more money in the last few years studying this side of the problem than the state has expended in the operation of the Lawrence Experiment Station since it was started. As the result of these mill studies, one large corporation has a wool-cleansing plant costing more than half a million dollars, and is getting from the wool, as a by-product, a large amount of grease which is sold at a profit. It is called a "secret process," but really is simply the naphtha process carried on in an up-to-date and scientific manner.

Our factory wastes have been studied, but I will not review the results here; they are embodied in the reports of the Board.

In regard to Mr. Winslow's paper—if it is to be discussed at this time—I will say that I have enjoyed listening to it very much; but I would like to remark—without any great degree of criticism—that it is written, I think, on the basis of drawing conclusions from results obtained with rather short experiments, these experiments extending over a year or two only. The results of a year or two of operation of the newest style of filters, contact and intermittent-continuous

or sprinkling filters, etc., can be summed up and made of considerable value. Two or three years' experimental work on sand filtration is not, however, of such great value that valuable conclusions can be drawn. I have no doubt that higher rates can be followed with sand filters than are followed generally, but these high rates mean in the end, simply the removal of much material from the surface of the filter. If by a carefully cared for surface, Mr. Winslow means the frequent removal of the accumulated organic and clogged matter, why, of course, higher rates can be followed.

One of the objects at Lawrence, during the past twelve years, has been to learn at what rate a permanent sand filter can run without the necessity of removing material from the surface of the filter; that, it seems to me, is a very practical point in the operation of sand filters.

As to Mr. Soper's paper, we have done a very large amount of work on the shellfish question in Massachusetts during the past four years. We have examined, I think, about two thousand samples of shellfish and a great many samples of sea water from the shellfish areas. We have found that pollution extends in some cases perhaps three miles from the sewer, but are still studying the limit of pollution. We have studied, to a considerable extent, the destruction of bacteria in shellfish by the ordinary methods of cooking, and find that some of the common methods are imperfect safeguards. Clams are often cooked at a temperature too low to kill many of the bacteria within them; and the oysters in the ordinary oyster stew that is eaten in a hotel, ordinary restaurant or eating house where the milk is heated and oysters thrown in, may contain many bacteria when they reach the customer. Some of the cooking methods destroy the bacteria, but it is really the aim of cooks to cook oysters as little as possible, thus keeping them as tender and palatable as possible.

There is still much work to be done on the shellfish question.

MR. GEORGE A. JOHNSON, of Columbus, Ohio.—Naturally enough, one of the first features to be considered in connection with sewage problems where purification is necessary has to do with the relative costs of the various methods of artificial treatment. This feature has particularly to do with the availability of the filtering material. Here in New England there are extensive areas of porous soil such as are almost entirely absent in the Central West and in the South. It has become necessary in such localities, therefore, to consider carefully certain of the more recent developments in the field of artificial sewage purification, such as the use of contact filters and sprinkling filters.

I have been particularly interested this morning in listening to Mr. Winslow's remarks, and am sorry he cannot give us any information

of a definite nature regarding the efficiency of sprinkling filters in the treatment of the sewage of this city. In Columbus, where the city has been conducting experiments for the past year, we have met with a considerable degree of success in treating the sewage of the city in sprinkling filters.

One of the features in Mr. Winslow's paper which particularly interested me related to his views regarding the efficiency of the septic treatment. There has been a quite generally recognized theory that the septic treatment, in addition to the removal of suspended matter effected and the dissolution of a portion of the sludge thus deposited in the tanks, renders the dissolved organic matter in the sewage much more amenable to subsequent treatment by subsidiary devices, than is the case with crude sewage. Mr. Winslow's remarks, as well as our experience in Columbus, quite clearly indicate that this theory is not well-founded. Apparently the greatest benefit to be derived from the septic tank treatment is in cases where the period of septic action, or perhaps more properly the velocity of flow through the septic tank, is such as will permit of the deposition therein of the maximum economical percentage of the suspended matter which the affected sewage contains. The liquefaction in the tank of a certain percentage of this sludge follows as a matter of course.

Regarding the amenability of septic sewage to subsequent treatment, I was somewhat surprised to learn from Mr. Winslow that he has found the effluent of septic tanks to be really more difficult to purify in subsidiary devices than crude sewage. His trouble must have been due to over septicization, a feature which was not encountered at Columbus. In general terms, it seems to me he did not place quite enough stress on the value of preliminary treatment, for the reason that in all sewage problems a feature of the most vital importance is the question of how the sludge shall be disposed of. If crude sewage may be treated as successfully on sand filters or coarse-grained beds as settled or septic sewage, it follows, of course, that inasmuch as the crude sewage contains more suspended solids than settled or septic sewage, we must balance the cost of the removal of the sludge from the settling or septic tanks against the cost of removing clogged material from the filters; and there seems to be little doubt that the latter treatment will always prove much more costly. It is the speaker's firm conviction that some form of preparatory treatment is well nigh imperative for reasons of economy in practically all cases where the purification of sewage is to be undertaken.

Mr. Clark's remarks relative to the value of short experiments are, of course, well founded, but we feel in Columbus that considerable

information has been gained during the past year. The city has just completed plans for a twenty million gallon sewage purification plant, based on the results of the experiments which were begun a year ago. These plans were submitted to the city council on yesterday, and call for a septic tank and sprinkling filter system; that is, a plant wherein there will be obtained a period of septic action of about eight or ten hours, the effluent of the septic tanks to be treated in sprinkling filters at a net rate of two million gallons per acre daily. There will be ten acres of sprinkling filters.

Our experiments were quite exhaustive, and were conducted in as thorough a manner as possible, covering several of the best known methods of sewage treatment. The test devices numbered forty-four in all, in which there were treated about 350,000 gallons of sewage daily. There were five septic tanks in which the periods of flow ranged from four to twenty-four hours. There were two settling basins in which the period of sedimentation was four hours in one case, and eight hours in the other. We experimented with chemical precipitation processes, but inasmuch as Columbus sewage is domestic essentially and exceedingly hard, chemical precipitation proved unsuccessful and experiments were discontinued early in the tests.

Another preparatory treatment which we studied was straining through shallow layers of coke at net rates of 1.5 and 3.0 million gallons per acre, daily, respectively. We had two coke strainers, one of which was protected against the elements, and the other located in the open. No ill effects from freezing of the coke layers were encountered at Columbus, although the atmospheric temperature for several days at a time during the tests was below zero.

In twenty-one sand filters we studied intermittent sand filtration with considerable thoroughness. The chief difficulty in this form of sewage treatment at Columbus relates to the non-availability of sand of suitable size in adequate quantities. The natural sand about Columbus is not very uniform, and the areas of desirable soil are very small. If sand filters had been adopted at Columbus, it would have been necessary to transport the sand from Lake Erie at a cost of about \$1.15 per cubic yard, making sand filtration for that reason alone an exceedingly expense proposition.

The sprinkling filters which we tested were constructed in a manner similar to those which Mr. Winslow is studying. They were composed of broken limestone, the size of the particles ranging from half an inch to two and a half inches, and averaging about an inch and a half. The beds were five feet in depth, and six in number. We applied sewage which had received various preparatory treatments to

these beds through sprinkling nozzles at rates ranging from two million gallons to five million gallons per acre daily. No trouble was encountered at any time due to freezing of the sprinkling nozzles.

We studied contact filter treatment with six beds, two of which were constructed of broken limestone, and four of crushed coke. Our experiments with contact filtration resulted in every way similar to those narrated by Mr. Winslow. It seems to be problematical, even at a net rate so low as half a million gallons per acre daily, whether it is possible to always get a non-putrescible effluent from single contact filters, or that a double contact treatment at an equal rate per acre will uniformly yield a stable effluent.

Sprinkling filters, such as were later adopted by the city, were shown to be far superior to contact filters. Whereas it was only possible to treat about half a million gallons per acre daily in a single contact filter, and then get only indifferently good results, with sprinkling filters we found we could normally obtain an effluent which was stable and satisfactory at a net rate of two million gallons per acre daily. The effluent of the sprinkling filters, of course, if operating properly, contains a comparatively large amount of suspended matter, otherwise the beds speedily clog up and require a great deal of attention. It is the desire at Columbus to obtain an effluent which shall be in all ways desirable, and it has been decided to remove so far as feasible the suspended matter which the sprinkling filter effluent normally contains. Accordingly, two settling ponds are to be provided, in which a period of sedimentation of the sprinkling filter effluent of two and a half to four hours will be obtained. The suspended matter in these effluents is composed largely of coarse particles which readily subside. This subsequent sedimentation will remove all of this coarse matter and make it possible to obtain a final effluent which will normally contain not more than twenty-five to thirty-five parts of suspended matter per million, making it a desirable effluent from the standpoint not only of its stability, but of its physical features as well. The purification works proper are estimated to cost about half a million dollars.

DR. LEONARD P. KINNICUTT, Worcester, Mass.—I have listened with pleasure to the three papers that have been read this morning, but I should have done so with much less pleasure if I had had any idea that I was to be called upon to participate in the discussion.

Mr. Leighton's paper has been one of great interest and one that shows careful study of the question, and I should not, at this time, make any extended remarks if he had not referred to me, saying that I would give a short account of the pollution of streams by iron sulphate.

Sulphuric acid is largely used for the cleaning of iron, both in iron wire mills and in founderies. The resultant liquor, called pickling liquor, contains iron sulphate in varying amounts, and is, as a rule, run into the nearest water course. The water of most of our rivers and streams is alkaline and consequently the iron in this pickling liquor is precipitated with iron sulphate, discoloring and to a greater or less extent filling up the stream. Where large amounts of sulphuric acid are used for the cleaning of iron, as is the case in wire mills, this pollution of rivers can be prevented by showing the manufacturer that there is a profit in evaporating down the pickling liquor and recovering the iron waste it contains. Where the amount of sulphuric acid used is comparatively small, as is usually the case in founderies, it does not pay to attempt to recover the iron sulphate, consequently we cannot prevent its being thrown into the nearest stream. The only method that I believe is truly applicable in this country to prevent the pollution of our streams by trade waste is to show to the manufacturer that there is profit in recovering what he calls waste. Whenever we can persuade the manufacturer that he can make money from his waste products then we can easily prevent pollution, otherwise we cannot. A much more serious pollution of streams than the pollution from pickling liquor is the pollution from wood pulp mills. In the manufacture of wood pulp from wood the wood is treated with acid sulphite of calcium liquor. This dissolves out about one-half of the solid matter in the wood so that it can be said that for every ton of wood pulp obtained one ton of solid matter is thrown into the stream. This solid matter is a lime salt of sulphurous acid. It is soluble in water and cannot be removed from water by any cheap process. A great many attempts have been made from time to time by various chemists to discover some use for this substance, but so far without avail. They have also attempted to find a practical method of removing it from water, and in this they have also failed, and at the present time the manufacturer says to the sanitary inspector, if I am obliged to keep this waste out of the stream I shall be obliged to close down my mill, for there is no way known by which I can purify this waste product before throwing it into the stream, and the manufacturer is right. In three or four cases where injunctions have been served against wood pulp manufacturers from throwing waste into the stream the result has been the shutting down of the mill. Mr. Leighton has also spoken of tannery waste. There is no trouble in treating tannery waste so that it shall not pollute the stream, and I believe we can prevent the tanneries from throwing a large amount of waste material into the streams by showing them how they can obtain profit from the material

that they now allow to run to waste. For instance, in a great many tanneries the hair from the hides is allowed to run into the stream. This can be prevented by a very simple device and quite a sum of money made by the tanner in selling the hair so recovered.

The second paper of this morning's meeting, Mr. Winslow's paper, giving an account of the results of his experience with septic tanks and contact beds when used with Boston sewage, was one of very great interest, and throws a great deal of light on the methods which should be employed in treating a sewage similar to Boston sewage. Boston sewage, or rather sewage experimented on by Mr. Winslow, contains an enormous amount of calcium sulphate. This calcium sulphate is, to a large extent, reduced probably by bacterial agents and results in the formation of sulphide of hydrogen, and certain of the results obtained by Mr. Winslow may be accounted for by the presence of sulphide of hydrogen. He found that with Boston sewage it made no difference with the effluent from the septic tank whether the contact period was eight hours or forty-eight hours, and further, that the results obtained from the contact bed were better when crude sewage was run upon the bed than with the sewage from the septic tank. These results do not coincide with the results obtained in other places and it seems to me that it must be due to the particular characteristics of the sewage experimented with. Experiments that he is now conducting, having for their object the study of percolating filters in the cold winter weather of New England, the results of which he will undoubtedly give us next year, will be waited for with interest.

Dr. Soper's paper on the danger of shell fish which have received nourishment from polluted waters shows us the danger, not only from allowing the pollution of our rivers and streams with sewage, but also the danger that may result from running sewage into the salt water.

DR. H. B. BALDWIN, of Newark, N. J.—I would like to relate briefly an experience with some oysters which may be of some interest and which incidentally may have some bearing on the toxicity of copper.

Some time ago some oysters were brought to my home which had a peculiar color. They were covered with bluish-green patches. They did not have a very appetizing appearance, and they were returned, to be substituted by others later in the day which I did not see. One of the bluest looking oysters was saved, and the rest were fried. The housemaid ate two or three raw oysters, soon after which she began to suffer from symptoms of metallic poisoning. I ate several cooked oysters and had mild symptoms of nausea, the oysters at the time having an astringent metallic taste. The other members of my family

refused to eat any. The one oyster which was saved I examined, and found it to contain one-quarter of a grain of metallic copper.

The subject offered interesting opportunities for investigation, and inquiry developed the fact that the dealer who sold the oysters had had similar complaints from other persons to whom some of the oysters were sold, and sickness had occurred in several instances. However, the difficulty of getting any more of the same lot of oysters from the beds which produced them stopped further investigation, so that I only had this one oyster to examine in which metallic copper was found. But it was ascertained that the shell fish came from a region situated near a large copper works, and possibly that may offer some explanation of the copper being present, which apparently was the case.

In view of the fact that copper has been exploited recently for the destruction of pathogenic organisms and algæ, it would seem that any sickness which may have been caused by the eating of the oysters was probably not the result of pathogenic germs.

MR. FREDERICK S. HOLLIS, of New Haven, Conn.—There is one point I wish to refer to briefly, and that is in connection with the condition of sewage coming from certain manufacturing towns. We have heard from the previous speakers that such sewage may contain iron in solution from the pickling fluids from the iron works. It might have been inferred from what has been said, it seems to me, that it is uniformly mixed throughout twenty-four hours.

A good deal has been said in a preliminary way with reference to future purification. Samples taken from the outlets of sewers coming from several thriving cities show that there are periods when iron is most abundant. As I remember it—I have not the figures here—there are two periods when the iron is present in the main, which would make it necessary to remove it before allowing the sewage to go on the filter bed. During the remainder of the day the iron in the sewage is low, and it might in most cases be neglected. It seems to me, if the presence of iron makes it necessary to treat sewage in a preliminary way by means of lime or any other precipitant for the removal of the iron, we must consider the advisability of separating the sewage for the periods that contain iron, and if possible treat them separately. In treating a large volume of sewage for the entire twenty-four hours, it seems not unlikely that by means of an agreement or an arrangement with the manufacturers this emptying of the sewage containing much iron into sewers might be done at certain hours of the day so as to facilitate this treatment.

DR. JOHN A. AMYOT, of Toronto, Ontario.—It seems to me, from

an economical standpoint, it would be better, in cases of these large trade wastes, to advise the city to put in plants at the factories, and then treat the ordinary sewage afterwards. In other words, it would be better to treat factory waste at the factory before it went into the sewers. At one place in Ontario, where disposal works were put in, the tanneries have been induced to give a preliminary treatment to their wastes before putting them into the sewer, so that all waste coming from the tanneries is made uniform for the whole of the working day. Where it is impossible to persuade the manufacturers to put in apparatus at their own expense, it would be economical for the city to do it for them from the ease-up that their own works would receive.

DR. HENRY J. BARNES, of Boston.—I would like to know what relation there is between the water consumption and the sewage flow per capita from any district in Boston?

MR. WINSLOW.—I am not quite sure about the water consumption, but the sewage flow of the South Metropolitan District is 250 gallons per capita.

DR. BARNES.—I have seen it stated at 125 gallons per capita of water consumed.

MR. WINSLOW.—The sewage flow is considerably higher than that. There is a leakage of ten per cent. of sea water alone in the Boston sewers, and of course, a considerable leakage of ground water also.

DR. WILLIAM BAILEY, of Louisville, Kentucky.—I simply want to call attention to one point in the first paper that was read. I understand that this was set forth as a principle, that the manufacturer has a perfect right to turn any product into the streams which is detrimental even to life, and the health officer cannot in the courts make a case unless he can give him a remedy. If that be true, I do not believe that the courts of this country will give any manufacturer the right to contaminate a water supply which I am obliged to use if it will result in my death. Even with one death, I would say, quit the operation.

MR. ELMER G. HORTON, of Columbus, Ohio.—There is one point to which I desire to call attention, and that is, in our investigation of the streams in Ohio some years ago we noticed that when one of the manufacturing wastes was introduced into the stream the bacterial content of the stream kept up for a considerable length of time. It seemed to continue after the chemical evidence of pollution began to fail. This is a little point, but it may have considerable significance in reference to the continuance of pathogenic bacteria.

DR. HENRY D. HOLTON, of Brattleboro, Vt.—I would like to have any of the members state from their reading and observation what the

number of gallons per capita may be for each individual in urban and rural communities.

MR. WINSLOW (closing the discussion on his part).— A question has been asked in regard to the per capita sewage flow in various communities. In the less populous districts it is small, perhaps in some communities, only twenty-five gallons or less per capita. With an increase in the size of a city, and an increase in the area of paved streets and amount of rain water contributed, the per capita flow increases rapidly.

As regards the treatment of sewage for the removal of solids, that must vary in different cases. It has been shown that in many of the English cities preliminary treatment is necessary. I do not believe, however, we have sufficient data upon which to dogmatize and say that preliminary treatment is always necessary or desirable for American sewage.

It is not fair to say that the solid material in sewage must be disposed of either before filtration or afterwards, because in many aerobic filters a large proportion of the material is oxidized and removed.

Furthermore, the solids deposited on the surface of a sand filter and the solids which come through in the effluent of a trickling filter are in stable and innocuous form. Our sand filter running at a rate of 400,000 gallons per acre per day has been raked over three times and scraped twice. The total amount of material removed amounted to less than half an inch in thickness.

In many cases, no doubt, preliminary treatment of sewage for the removal of organic sludge may be desirable. In other cases we believe that purely aerobic treatment on sand or in the trickling filter may be most satisfactory.

MR. LEIGHTON (closing the discussion).— I have only a word or two to say in reply to the question of Dr. Bailey. When Dr. Bailey has had an opportunity to read my paper, he will appreciate that I am not trying to enunciate a new code of ethics, but to state a deplorable fact. It is a fact that in our present light, if we wish to institute a reform, we can do it more easily upon the basis of the Almighty Dollar than we can upon the basis of life.

When we come to the question of trade wastes, where we take it up as to the matter of exact justice, justice which is ideal and should be administered, Dr. Bailey's position is absolutely correct. But in the long line of litigation in American court practice we cannot get it, and the manufacturer will defeat us in the majority of cases in the courts, if it cannot be shown absolutely by the authority which is given him that it is better to abate a nuisance, or if it can be pointed

out that it can be abated at a reasonable cost and comparatively easily. That is the condition if you look over the history of court procedure with reference to this thing. My whole point in making the statement was, that being the fact, let us make the best of it and adjust our procedures so that we will get the greatest good out of the money which we expend on our experiments.

On motion of Dr. William Bailey, which was duly seconded, the Association adjourned until 3 P. M.

FIRST DAY — AFTERNOON SESSION.

The Association reassembled at 3 P. M., and was called to order by the President.

Mr. Allen Hazen, of New York City, delivered an address without manuscript, on "Recent Water Purification Plants," which was illustrated by numerous stereopticon slides.

At this juncture the Secretary read the following telegram from the New Orleans Times-Democrat:

NEW ORLEANS, Sept. 26, 1905.

DR. F. F. WESBROOK, *President of the American Public Health Association*:

The people of the Southwest await with great interest some declaration from the American Public Health Association relative to the yellow fever now prevailing here, and whether the disease is due to the *Stegomyia* mosquito or not, and expressing an opinion as to the valuable and scientific methods now being used here for the first time in fighting the disease.

(Signed.) *New Orleans Democrat*.

DR. WILLIAM BAILEY, of Louisville, Kentucky.— Being more nearly related to this stricken district of our country than many others here, I would beg leave to make a motion that a committee be appointed by the Chair to take this dispatch from the New Orleans Times-Democrat into consideration, and to make a report after the discussion on yellow fever has taken place, and that this resolution shall express the sentiments of the Association.

Individually, I would like to see a tail attached to that to the effect that the President of the United States be requested to stay away from New Orleans.

The resolution was seconded by General Woodhull, and was referred to the Executive Committee.

Mr. R. B. Dole, U. S. Geological Survey, then read a paper enti-

tied, "Sanitary Inspection Versus Sanitary Analysis." (See paper, p. 59.)

THE PRESIDENT.— I will name the committee asked for in Dr. Bailey's motion now. I will appoint Drs. John Guiteras, Eduardo Licéaga, William Bailey, Frederick Montizambert, James Carroll, and P. H. Bailhache. This, I trust, will make a representative and thoroughly satisfactory committee to consider this matter.

Mr. H. W. Clark, of Boston, read a paper entitled "Some Aspects of the Use of Copper Sulphate in Public Water Supplies." (See paper, p. 68.)

Mr. Earle B. Phelps, of Boston, read a paper entitled "Experiments on the Storage of Typhoid Infected Water in Copper Canteens." (See paper, p. 75.)

Dr. W. R. Stokes, of Baltimore, Maryland, followed with a paper entitled "The Effect of Copper Sulphate Upon the Bacteriological and Chemical Constituents of Large Bodies of Water." (See paper, page 91.)

A paper entitled "Observations on the Distribution of *Bacillus Coli* in Lake Erie, Near Cleveland," by Mr. Geo. E. Willcomb, of Watertown, N. Y., was read by title. (See paper, page 101.)

The above papers were discussed jointly.

DISCUSSION.

MR. GEORGE W. FULLER, of New York City.— Mr. President, Ladies and Gentlemen:— I think the Association is to be congratulated on the excellent papers which have been presented this afternoon on the subject of public water supplies. They certainly cover the most pressing and the most interesting phases of the subject as it is encountered in a practical way. In Mr. Hazen's descriptions he has selected for purposes of illustration, those plants which are typical of the best steps in recent improvements.

In regard to the operation of filter plants, I wish to endorse the statements of Mr. Hazen that this is a very important feature, and one in which the members of this Association can now make their influence felt to the material benefit of the public water supplies. The reduction of typhoid fever in those communities having good filter plants is striking indeed. It is a subject, however, which demands further inquiry, in order that the full benefit of various features may be duly appreciated. There are other things than water which convey typhoid fever. Some are understood in a general way, such as milk, vegetables and the like, and there are other features that are coming more and more to our attention.

One in particular I desire to refer to, and that is the question of transmission of infected typhoid material by flies. This feature was called to my attention quite strikingly about a year ago in the course of some investigations at Indianapolis, Indiana. In that city, as in many others in this country, there are only a few sections, outside of the commercial district, which are well sewered. That is to say, the majority of the residential districts are quite incompletely sewered. The result, of course, is that privy vaults are still there in large numbers. They are not screened or protected from the flies and there is no doubt whatever that at times they are a material factor in causing the transmission of typhoid fever.

In this general connection it may be of some interest to call attention to the decrease in general death rate which has occurred in New Orleans during the past three or four years. As you probably know in a general way, that city for several years has been engaged in various sanitary improvements which will represent an outlay of about sixteen millions of dollars and will require for completion of the work a period of years extending about to the end of 1908. Those works may be considered in three classes — a new water supply, a new sanitary sewerage system, and a new drainage system to remove the rain water. Each of these three projects will cost roughly the same sum of money. The drainage system, of course, is now the farthest advanced. Some four and a half millions of dollars have been spent, and during the past three or four years there has been derived great benefit from the large conduits and pumping stations which pump rain water to Lake Ponchartrain. Prior to 1902 the general death rate averaged about 28 per thousand, and since it has averaged about 21 per thousand, making a notable reduction for reasons which I will not now attempt to comment upon.

In regard to the value of sanitary analysis of water as compared with sanitary inspection, in many instances I think sanitary inspection is sufficient. That certainly is true when the water is badly polluted. When it is free of pollution, sanitary inspection is usually as good a guide as there is. There is, on the other hand, a class of waters which are perhaps not at all times above suspicion, and which sometimes are distinctly contaminated. With these waters analysis and sanitary inspection each furnish data which should be used in conjunction. There is one feature also to be noted in that connection, and that is, that here along the Atlantic seaboard, where the watersheds are relatively small, analysis usually yields data which may be used more readily, and in many instances, more reliably than can be said of very large watersheds in the central west.

A feature which was brought out also, I think, by Mr. Dole, is that the field of water analysis is shifting slowly but steadily, from what might be called the old-fashioned way of testing water from ponds, streams and reservoirs. Such analyses are perhaps now made less frequently than formerly; but there are being made, on the other hand much more frequent analyses than formerly in connection with filtration works. In this field, analytical work is bound to grow in the future very rapidly.

As to the question of copper sulphate, it is quite apparent that this subject needs consideration from two distinct standpoints, namely, as an algicide and as a germicide. As an algicide, copper sulphate has a distinct field of usefulness, and in many instances it can no doubt be used with great satisfaction. This applies particularly to those waters which are hard and which cause its decomposition as in the case of the sulphate of alumina, where the resulting compounds in solid form are removed by filtration. In soft waters, such as those which have been studied by Mr. Clark, the proposition is a different one, and certainly requires considerable caution before one arrives at final conclusions.

As to copper sulphate as a germicide, there are many instances throughout the country, which have been spoken of, partly in the technical press, and partly in the daily press, where attempts have been made to use this compound under conditions never contemplated by Dr. Moore or his associates. This question was discussed in an interesting manner some ten days ago at a meeting of the New England Waterworks Association, held in New York City. While there was a difference of opinion on the part of experts, Dr. Moore spoke truly when he said it was not a gunshot method applicable to all kinds of problems; but it had a distinct field of usefulness.

As the evidence now stands, we would not be justified in substituting the copper sulphate treatment for filtration. While filter works are being completed there may be isolated cases where benefit could be derived if it were applied very cautiously and in doses much larger than was considered necessary a year ago. Available data seem to indicate that concentrations of copper sulphate necessary to kill typhoid fever germs will have to be studied further, in my opinion. Many of the data are, of course, associated with peculiar conditions of the cultures being studied and with the laboratory technique, each of which is incapable of being controlled absolutely. I refer particularly to the point that it makes a great difference how virulent is the particular culture of typhoid fever germs being worked with, because many typhoid fever germs are killed when passed from culture media into

distilled water with absolutely no germicide there. That is to say, they are killed by osmosis; simply moving the germs from one liquid to another may in itself bring about sufficient differences in osmotic pressure to rupture the cells of fifty or seventy-five per cent. of the germs. It is not a question of applying doses of copper sulphate which will remove seventy, eighty, or ninety per cent. of the germs, but the process ought to be developed as to strength and conditions of dose so that ninety-eight or ninety-nine per cent. and more of the applied bacteria will be killed, including the most virulent type of these germs; which are the ones, so far as we know, that most likely convey typhoid fever and exert the most influence upon our vital statistics.

With reference to the use of copper sulphate with sand filters or mechanical filters, I think it is far better to have filter plants well built and well operated along their demonstrated natural lines than to try to resort to the assistance of copper sulphate.

MR. GEORGE C. WHIPPLE, of New York City. — So many interesting points have been touched upon this afternoon that I do not feel I can take them all up, yet I would like to say a few words in regard to some of them.

In the first place, the paper of Mr. Hazen is valuable in showing what filtration does, how it has reduced not only the typhoid fever death rate of cities but also deaths from other causes. I have been studying figures of that character for some time, and the more I study the subject the more I am convinced that there are many other water-borne diseases than typhoid fever. We do not know what the causes of some of those diseases are; but of the various forms of diarrhea and dysentery which are so common, some of the milder types, I believe, may be attributed to bacteria found in water. What these bacteria are, or how to identify them we do not know. We do not fully know. It may be the ordinary colon bacillus, or some of its allies, is not so innocent as we sometimes think. We pass over a little too flippantly the so-called "ordinary water bacteria." We have heard in this discussion that the use of copper sulphate has a selective action which tends to kill the colon bacillus, leaving untouched the "common water bacteria," and even stimulating their growth. We ought to investigate more thoroughly what these common bacteria are, and, if possible, find out more closely the relation between them and some of the milder types of disease which are so common in many places. While this is a difficult thing to do, I believe we will ultimately do it.

One of the important changes which has taken place in water purification during the last few years is the increase in the use of chemicals. We have a great many chemicals which we put into water in connec-

tion with purification processes — alum, soda, lime, permanganate of potash, etc. have been used; also ozone, and some of the compounds of chlorine; and, more recently, copper sulphate. On general principles, we ought not to use chemicals if we can avoid it, partly on account of cost and partly because the application of any chemical requires great care lest the right amount be not added. If too little is used the result is not satisfactory; if too much is used, it is expensive and may cause trouble. I believe, however, that our science of to-day is able to tell us whether or not these chemicals can be used safely, and, it seems to me, that where science teaches us that the quantities used are harmless and are efficient, there is no reason why we should hesitate to use them. I do not see why we should not put into practice our theories in sanitary science as well as in other branches of science. But, it seems to me, that before we make general use of such a substance as sulphate of copper, we want to know all the truth about it.

When we have had more investigations similar to those which Clark and others have made during the past year; when we have collected all the necessary data, we shall be better able to pass judgment on the whole question.

DR. PETER H. BRYCE, of Ottawa, Ontario. — The papers that have been read to-day have been important and extremely interesting to me from a standpoint that has not been brought out. One of the old features of the discussions which take place in our Association from year to year, which I have noticed, as I suppose many of the older members have noticed, has been again illustrated and is the curious swinging of the pendulum from time to time from one point of view to the other.

The paper that has given me most pleasure this afternoon, apart from the extremely interesting paper of my friend, Mr. Hazen, is that of Mr. Dole, who spoke about the necessity of distinguishing between knowledge gained by chemical examinations or bacteriological investigations and the sanitary inspection of water supplies. As an old health officer, endeavoring to keep my province in order, I, with many others, often noticed how constantly in any town the potability of a water supply was determined by a single isolated chemical examination which had to be paid for. An examination once a year, or once in five years was supposed to determine the sanitary value of a water. The sooner we all learn to know better and direct our attention to having sanitary laws made so positive that when a water supply is to be established for a town intelligent investigation of the source of supply, as regards present or future pollution, must be made before the water supply is to be used, the better it will be for us and the com-

munities we represent. There ought to be required positive legislation by which all causes of probable pollution within a reasonable distance above any public water supply shall be removed by law if necessary. This was the case in the province I formerly represented. The effects of those laws were perfectly evident, and the reasons therefor have been set forth by Mr. Dole, so that I need not further point them out at this time. In the one case, where sources of pollution are removed, you know you have not got danger present in the shape of sewage. In the other, where a polluted water is to be filtered, you are constantly thinking whether the filters work daily, or whether an analysis is made daily, or whether some such thing takes place as did with the Altona filters, which we remember in connection with the cholera of 1892 in Germany and the investigations which followed. You will doubtless remember that one filter got frozen and refused to work at Altona, while others had to do excessive work and cholera appeared after months of imminent dreaming, while Hamburg opposite was devastated. It is like depending upon a machine that sometimes or frequently goes wrong; whereas by keeping the source of water free from pollution we are carrying out, in my judgment, the first and always the best principles of preventive medicine, namely, preventing the danger.

We have all noticed how, in the matter of diphtheria, the use of antitoxin has not, while lessening the mortality, necessarily by any means decreased the number of cases of that disease; but the free use of it has lessened the danger or the means by which the old-time isolation went into desuetude to some extent. In the same way we have had in some other cities those who tell us that vaccination is not protective against smallpox, and that we had better resort to isolation and disinfection rather than possible prevention. Such preventive principles are, I think, sometimes forgotten in our attempts at studying and investigating new methods.

MR. CHARLES P. MOAT, of Burlington, Vt.—Replying to Mr. Dole's paper, read this afternoon, I do not think that here in the New England States, at least, we are yet ready to determine the pollution of water by inspection alone. I have always believed thoroughly that one method of analysis is not enough in determining water pollution. I think we should have field inspection, chemical and bacteriological examination, of all suspected water supplies. In many cases there is no doubt we do needless work when in the field. We can see effluvia running into the stream or source of water, and in many cases when we can determine sewage bacteria there is no need of going through an entire sanitary chemical analysis. In many cases I think we need

three examinations — chemical, bacteriological, and a field examination in our work, especially here in New England, and I do not think we are yet ready to rely on one alone. I know we are not in Vermont.

MR. E. C. LEVY.—I have enjoyed very much the paper of Mr. Dole. It seems to me, however, the title of the paper is rather unfortunate, "Sanitary Inspection Versus Sanitary Analysis." There should be no contrast drawn between them, but the two methods should work together. My attention was especially drawn to that in a recent case which I had in West Virginia. In the examination of spring water which was reported to me, I found the conditions absolutely different from what one would expect in a spring water. I merely wish to show how necessary inspection is. This was in a limestone country, and I stated in my report that this water should be regarded as water from a common ground stream, not a spring at all. In that neighborhood there were sink-holes, and I could not have formed any opinion of the water from mere analysis. I directed them to send me a sample of some of the water, and after a rainfall I found the conditions very much changed so that it was necessary to caution them to watch out in the neighborhood of every house, of which there were only half a dozen, for proximity to sink-holes and to regard that water as from a stream, and not from a spring, which would have been regarded as such on the report which they sent in.

Regarding the influence of copper sulphate, the diversity of results can only be accounted for by diversity in the water differences. It is striking to me that the favorable results I have seen from laboratories have come not from one observer but many. Dr. Cramer and Dr. Pennington and a good many others have reported uniformly good results from laboratory work. In other sections the results would seem to be uniformly bad, and it seems to me a thorough mineral analysis of a water treated is absolutely essential as a preliminary step in determining the value of sulphate of copper treatment. I do not see how the figures of Mr. Clark, showing the persistency of copper, can be accounted for in any other way except by the absence of the alkalinity at which the copper is precipitated, where good observers have found it to disappear rapidly. The first essential is a complete mineral analysis of a water treated by this method.

MR. FREDERICK S. HOLLIS, of New Haven, Conn.—In regard to the matter of inspection as compared with analysis, I would like to express my opinion on this subject. My experience has been mainly in Massachusetts, where for a number of years I had charge of the laboratory of the Metropolitan Waterworks, and I came to realize fully the extreme value of inspection work. It is the only way that we can

form an opinion of the nature of the possibilities of pollution. But I would not like to say that inspection should take the place entirely of analytical work. It should supplement it, or rather I might say the analytical work should supplement careful inspection in the field, and they should go together. From the two we are able to state definitely: first, from the inspection, whether a water is polluted or not, and then the inspection is confirmed by the analytical results. If we were to rely entirely on the analytical results, we might in the case of reservoirs of Boston be misled. We have waters that have considerable color, and on analysis yield the albuminate of ammonia, sometimes free ammonia and other constituents which are identical with the material coming from sewage; the experienced analyst can state clearly that it was organic matter from growths rather than from sewage, yet it would not be conclusive. But by inspection, coupled with the analytical results we can state clearly that the origin of that material which appears in the analysis is harmless. That is further borne out by a bacteriological examination of several sets of reservoirs which I have followed for a number of years. And it is rather surprising that those microscopic organisms which impart a disagreeable odor and taste to the water do not in one reservoir develop in quantities sufficient to cause trouble as they do in many other reservoirs.

In regard to copper sulphate, I do not think we can draw any general conclusions. We have had simply a record of a few tests presented, and it is one of many agents that must be brought together before we can hope to draw any general conclusions or even determine the best method of applying copper sulphate. This year we are having a collection of results, especially at the meeting of the New England Waterworks Association, held in New York City, to which Mr. Fuller referred. We had accounts not only from the New England States, but several important ones from the Middle West, where the water is harder and the bacteria more virulent than is the fact in the waters of New England. One thing in particular was pointed out, namely, that in water having a hardness of about four hundred and an alkalinity of about one hundred copper sulphate applied in the ordinary way to remove algae was precipitated in forty-eight hours entirely. That is different from the accounts given both there and here by Mr. Clark. Alkalinity must be considered a precipitant of copper. Other things probably influence the precipitation of copper, as free carbonic acid, and while we have no definite knowledge on the subject undoubtedly the presence of certain organic matters in solution, such as we have causing the color of our Northern waters, may influence the precipitation of the copper.

MR DOLE (closing the discussion). — I have been much interested and instructed by the remarks on the paper I read. I realize that there are men here whose years of experience far exceed my own with reference to water purification; but it was my aim to draw attention to the details of a work which apparently has been neglected in the past. We have spent a great deal of time on analytical work, and not much time on the large features of the inspection of the sources of water supplies which we are examining.

On motion, the Association adjourned until 8 p. m.

FIRST DAY — EVENING SESSION.

The Association met in Huntington Hall, Rogers Building, Massachusetts Institute of Technology, and was called to order at 8:15 p. m., by Dr. Henry P. Walcott, of Cambridge, Mass.

There were on the platform the President, Drs. Frederick Montizambert, Henry D. Holton, Wm. Bailey, Chas. A. Lindsley, Henry Mitchell, Eduardo Liceaga, ex-Presidents of the Association; the Secretary, and Dr. John Guiteras.

Prayer was offered by Rev. Dr. Mann, rector of Trinity Church, Boston.

DR. HENRY P. WALCOTT, of Cambridge, Mass. — Ladies and Gentlemen, Members of the American Public Health Association: It is with very great pleasure that I find myself in a place which I occupied as President of this Association for the purpose of bidding you welcome to the city of Boston. In doing so, one naturally goes back to the fourth annual meeting of this Association, which was held in the city of Boston in the year 1876. The chairman of the Committee on Reception on that occasion was Professor Nichols, of the Institute of Technology, one of the great laymen who has contributed so much to the interest of public health. The presiding officer of this Association was Dr. Edwin Snow, of Providence, one of the great municipal sanitarians, and my own great predecessor, Henry I. Bowditch, represented at that time the commonwealth of Massachusetts. What a change has taken place since that time. The discussions then were devoted to very much the same topics that this meeting of the Association is devoted to. They lamented, however, the absolute ignorance which the public health authorities of that day then possessed with regard to consumption, scarlet fever, diphtheria, yellow fever and malaria. However, the discovery of particular species of mosquitoes has given the key to the mysteries of malaria and yellow fever. Antitoxin has given us a remedy, more or less complete, for diphtheria,

and we can only hope the next twenty-nine years will do as much for us as the twenty-nine years which have elapsed since that time. But I do not pretend to worry you or try your patience by indulging in reminiscences.

As public health officers, you know very well that we can do very little without the assistance of the law. In Massachusetts, through all these years of successful sanitary legislation we have received the utmost assistance from the law officers of the commonwealth, and from no one have we received greater help than from the gentleman who now fills the office of attorney-general and whom I now introduce to you as the representative of the state on this occasion — Hon. Herbert F. Parker. (Applause.)

ADDRESS OF WELCOME ON BEHALF OF THE STATE BY
ATTORNEY-GENERAL HERBERT F. PARKER.

Mr. President, Ladies and Gentlemen, Honored and Honorable Guests: — In your presence I rise inhaling the very breath of immortality, for how otherwise could it be in the company of a national public health association? (Applause.) I congratulate you and the world upon the great achievements of your Association, or, at least, through the coöperation of your Association. In twenty-nine years I have learned through that fount which we in Massachusetts accept as infallible that you have banished almost all the diseases that flesh is heir to. The few remaining ones that have a noxious existence, I am sure, will find their end before twenty-nine more years shall have been measured to your credit. It is with no vainglorious spirit of provincial pride, but rather with a sentiment of true maternal affection, that the commonwealth of Massachusetts opens her gates to you to-day. She invites you to examine the evidence of her material and moral progress. But best of all, she asks you to sit at her fireside in the intimate and cordial hospitality of a mother for her children, for, I am sure, ladies and gentlemen that from whatsoever state of this great sisterhood of our Union many of you may have come hither, you have all pride, some sentiment of filial affection and respect for this old homestead of yours, for the children of the Union are in large part the children of the old commonwealth of Massachusetts. You have come — you who are our kindred — to inquire what sort of housekeepers we have been who have had charge of the mansion of your ancestry. We open every room to the inspection of our returning relatives. We ask you, if you find anywhere evidences that doth corrupt, that you aid us in expelling corruption from your heritage — aid us in purifying

ourselves, and we will not forbid you to open the doors of our closet, though perchance you may find a skeleton or two. They are all inheritances of respectable forms, and if you should be inclined to shake and rattle some of these bones, the skeletons of our past history, as, for instance, the persecution of the Quakers, or the persecutions of witchcraft, handle your relatives and descendants of Massachusetts — these skeletons — a little carefully, lest the rattling of these bones stirs your own self-consciousness of something connected with the past.

We want you to do all you can toward uplifting the community where your activities are scattered, for I am told there are still those who have attended this convention here in Boston who are from beyond the borders of our Republic. To them the commonwealth extends a grateful and cordial welcome. Bring to us what your experience, your learning, your training has taught you. Teach us how to battle with the ills that attend this human life of ours. Tell us something of the heroism, something of the devotion of those who give their lives to the profession which you uphold and serve, for truly your achievements have been great, noble, high, and most exalted in the most beneficent science that man knows, that of medicine. If all are not born of this New England ancestry, I think most of you, like those of us who dwell here, love to think and believe that the line of your descent may be traced to the pilgrims and to purity. What are you but Puritans in purpose and aim? You purify, you uplift, and you teach the living of a simple, pure, clean life. You are the Puritans who have taught that cleanliness, moral and physical, is Godliness, and no more potent influence is at work among the working, thinking people of our day and time, and of our entire world. But let me make this suggestion to you with the utmost humility and timidity: Let not your sterilizing processes go too far. The great processes of nature are safe, and that danger attends some of their manifestations. It is not well for human agencies to attempt to attain absolute purity in our surroundings. I am a parent — a proud parent of wide experience. Happily, most of my children have survived; but the first of them in infancy had perilous times. The source of infantile sustenance was over-sterilized. No cow was permitted to approach the nursery unless she had undergone some antiseptic treatment; and sterilized food was all these younger children of mine had, brought to them in sealed glasses. They survived it because they were born of that race which throughout its youth lived up to the tradition that unless a child assimilates a peck of earth in its infancy it will never grow to vigorous manhood or womanhood. (Laughter.) Do not sterilize too much. Expel and purge uncleanness from all

conditions which surround us. But let not any of us arrogate to ourselves that it was left to us to completely dominate and control the processes of the Almighty. See to it that the evils that come from our earth or the world being populated with teeming humanity are kept under control.

There is a legal fiction in this commonwealth of ours that the law officer of the State advises and guides all departments, including the State Board of Health. But, my friends, it is but a fiction. The Attorney-General of Massachusetts, knowing well his rightful province, ventures to suggest to the Board of Health what might be done, but never to advise. And why? Because it lies in their power to quarantine either the person or the opinion of any disobedient citizen of Massachusetts, and those opinions, of which they do not approve, are placed in quarantine and rarely released. There is but one tribunal within this commonwealth that dares to question, or has the hardihood to question the work of this Board of Health. But the judges alone dare advise with the Board, but so far as I know, they have not yet tried to overrule any adjudication of the State Board of Health of Massachusetts. I speak to you, my friends, not as one arrogating the right or power to advise this Board, which in all seriousness, I tell you, has done more for the advancement of the real interests of this commonwealth than any other, unless it be the Board of Education. (Applause.)

Let us see what it has done in this commonwealth. If you dare drink a cup of colored water which has been offered to you in this city, its safety lies in the precautions taken by this Board, at whose suggestion, upon whose initiative, the greatest water system for the safety of the great commonwealth is now in process of construction. Taught and instructed by a Commission acting in coöperation with you, and along the same lines that your efforts traverse, the people of Massachusetts have come to know that the sanity, moral and physical, of a community rests primarily upon physical conditions. It is a matter of pride to me personally, that I am permitted to rise and inadequately, in the name of this commonwealth, bid you welcome. Analyze our condition; analyze our being, physical and moral, and though you may find some taint, some evil that should be expelled, I think you will not find within the borders of any one of the civilized communities of our time a sentiment more absolutely in sympathy with your efforts than the sentiment of the people of this great commonwealth which welcomes you to her doors to-day. (Applause.)

DR. WALCOTT. — I have been looking about this hall, and I see but one face that could possibly have been seen in the convention of 1876,

and that fortunately is the face of the Chairman of the Boston Board of Health, for every year since the year 1876 he has been the Chairman of the Municipal Board of Health, and under his industrious and always competent administration the city of Boston owes all that it has in the way of sanitary improvements. Ladies and gentlemen, I present to you Dr. Durgin. (Applause.)

ADDRESS OF WELCOME BY DR. SAMUEL H. DURGIN, ON BEHALF OF THE CITY OF BOSTON.

Mr. President, Members of the American Public Health Association, and Visiting Friends:—By the death of our late and much lamented mayor, and by the illness and inability of our present mayor to be here to-night, it becomes my pleasant duty to greet you in our city, and to extend to you through our citizens their warmest wishes and welcome.

I shall have to ask you to bear with me, since at four o'clock this afternoon I first learned that our mayor could not be with you, and that I must appear for him, during which time I have not been able to think of what I might say to you. Therefore, I have the mortification of being tied to a few notes rapidly spread upon a bit of paper.

I greet you in behalf of our city and extend to you in behalf of our people their warmest Massachusetts welcome.

We recognize that this Association does more for the public health than any similar organization on the American Continent. You have the doctor, lawyer, engineer, chemist, pathologist, entomologist, statistician and the layman as members, harmoniously united under your banner, in a spirited effort to prevent disease and to prolong life. The local and general organizations which you represent are clothed with extraordinary power. With many of you the means for research into the cause and prevention of disease are almost unlimited, but they are as valuable and necessary in modern public health work as are the chart and compass of the mariner. Your laboratories deal with the food we eat, the water we drink, the air we breathe, and with the soil we occupy, and the successful results of your researches are interpreted to the people in the daily duties of the experienced and instructed health officer. Trade and commerce have been largely relieved of the doubt and hindrance formerly imposed in the absence of definite knowledge. The annoyance of so-called quarantine has given place to simplicity of treatment, and a better guarantee of safety to the public by the modern health officer. The imperative treatment formerly made necessary at the port of entry has been largely relieved by

proper inspection, by preventive treatment at the port of departure. For this great progress we salute you as public benefactors. As a body, you make annual calls. Once in each year you leave your duties, assemble in some selected and favored city to which you have been invited. You carry good news, compare notes, and leave an inspiration. We shall do all we can for your comfort and pleasure. We wish for you the largest measure of success in your work. We hope you will stay as long as you can, and let me assure you that while you do stay Boston is yours. (Applause.)

Dr. Walcott then introduced the President of the Association, Dr. F. F. Westbrook, of Minneapolis, Minnesota, who delivered his address. (See page 1.)

On motion, the Association then adjourned until 10 A. M., Wednesday.

SEPTEMBER 26TH — SECOND DAY.

MORNING SESSION.

The Association met at 10 A. M., and was called to order by the President.

THE PRESIDENT. — We will now listen to a report by the Secretary from the Executive Committee.

THE SECRETARY. — The only report from the Executive Committee, Mr. President, is the appointment of a Committee on Necrology, but more especially to prepare and offer suitable resolutions on the deaths of Dr. Smart and Professor Drown. This committee consists of Dr. Walcott, Gen. Woodhull, Mr. Weston, Dr. Carroll, and Mrs. Richards, and the committee is to report Thursday afternoon.

The Executive Committee has considered and acted upon several applications for membership favorably, and recommends them to the Association for election.

DR WILLIAM BAILEY, of Louisville, Ky. — I move that the Secretary be instructed to cast the unanimous ballot of the Association for the election of those whose names have been presented. Motion duly seconded and carried.

The Secretary cast the ballot of the Association, as directed, and they were declared duly elected as members.

THE PRESIDENT. — The next matter to engage our attention this morning is the scientific part of our program. Professor Councilman is on the program to read a paper, but owing to a misunderstanding he was present yesterday to read his paper and cannot possibly be with

us to-day. This will be unfortunate for us; but Dr. Brinkerhoff, who has been associated with him, has been good enough to come to the meeting this morning, and will read Professor Councilman's paper.

Professor William T. Councilman, of Boston, contributed a paper on "The Etiology and Prevention of Smallpox," which was read by Dr. Brinkerhoff, in the absence of the author. (See paper, p. 218.)

Dr. Wm. T. Howard, Jr., of Cleveland, Ohio, followed with a paper on "The Pathology and Etiology of Human Vaccinia." (See paper, p. 230.)

Dr. W. F. Elgin, of Glenolden, Pa., contributed a paper entitled "Report of Further Experiments With Vaccine Virus," which, in the absence of the author, was read by title. (See paper, p. 235.)

Dr. Francisco De P. Bernaldez, of Mexico City, read a paper on "The Preservation and Method of Using Humanized Vaccine Virus in Mexico." (See paper, p. 242.)

The hour having arrived for adjournment, on motion of Dr. Wm. Bailey, the Association then adjourned until 8 P. M.

NOTE. — There was no afternoon session, as at noon the members and invited guests took a trip down the harbor on the United States revenue cutter *Algonquin*.

SECOND DAY — EVENING SESSION.

The Association reassembled at 8 P. M., and was called to order by the President.

Dr. Chas. B. Dudley, of Altoona, Pa., read the first paper of a symposium on "Car Sanitation." His subject was "Dissemination of Tuberculosis as Affected by Railway Travel." (See paper, p. 187.)

Dr. Henry M. Bracken, of St. Paul, Minn., read a paper entitled "A Few Points Relative to Car Sanitation." (See paper, p. 198.)

Dr. Juan Breña, of Mexico, read a paper on "Car Sanitation." (See paper, p. 215.)

These papers were discussed jointly.

DISCUSSION.

DR. G. P. CONN, of Concord, N. H., was asked to open the discussion. He said: Mr. President, and Members of the Association. — I feel that instead of opening the discussion on these papers I ought to apologize for taking an hour and a half of your time this morning in giving an object lesson on this subject. It seemed to me, however, that an object lesson given by one of the greatest railroads in New England would be of service to us all, as showing what a railroad is

really trying to accomplish. I believe that every person who saw the exhibiton of car cleaning this morning will feel that something has been accomplished by the work of this and other associations in calling attention to railway sanitation. I had the honor of bringing this matter before the International Railway Association more than ten years ago, at a meeting in 1894, and in looking over the time-tables, the rules and regulations of one of our large railroads, I found only four lines at that time that could be in any way interpreted as having to do with the sanitation of railroads, and that applied almost strictly to what the brakemen should do in the way of turning off and on the heat and perhaps opening the transoms of the cars. To day one road has more than three pages in its rules and regulations to trainmen of what they are expected and required to do in regard to what may be termed railway sanitation. Such being the case, I believe we may safely say that we have been doing good missionary work, and in that we are accomplishing something that will become more apparent in railway sanitation in the near future.

One thing which Dr. Bracken referred to was in regard to the use of ice-water in cleaning our teeth, etc., on the cars. Some have more use for tooth brushes than others. I am surprised that he did not suggest a remedy. A good Christian man like Dr. Bracken, if he belongs to the church and has a large influence at the present day, is not up in sanitation unless he is able to recommend that every traveler carry his own communion cup. (Applause.) There is just as much and more reason that he should have that every day than perhaps once in four Sundays, when he uses it in church. Let us remember that we do not know all there is about sanitation; that there are others, and I believe to-day our railway people, our good friends, are quite as far advanced as the average member of this Association; unless he has given special study to this subject, he is not farther advanced than the mechanic who is ever studying these methods. I have had something to do, as my friend Dr. Dudley has, with these matters. I have often been consulted, and I have yet to see anything recommended that was tangible and practical that was not willingly adopted. Now, trainmen, are reprimanded in the home office for neglecting matters which their rules and regulations expect them to attend to, as they are for other things. It may not be so immediately detrimental to life not to obey rules and regulations in regard to sanitary matters as it is to run by a signal, yet it means that it is all taken notice of. We have, as a rule, but little idea of the immense amount of detail work that is to be done by the different departments in railroading. It is an immense system. It means a great deal. Millions and millions of dollars are involved,

and, as sanitarians, when we are making these recommendations, let us be careful lest we infringe upon civil rights. The management of railroads are held responsible to the stockholders and to the public. We ask them to do things which it is impossible, because impracticable. If the public really mean what they sometimes say, the management would naturally feel that it was expected to substitute new cars as often as once a week. The last speaker had something to say in regard to a man being found dead whose duty it was to turn the signals, or something of that kind. Our newspaper friends provide us with all such news. On a single road running out of New York, in less than five years, two engineers have been found dead in their cabs. These things of themselves lead the management of railways to look for a remedy. Many railroads are to-day having examinations made of their employes by good medical men, repeated once in two years, not only in regard to sight, but also other physical conditions. This goes to show that the management is just as much alive to the good work of sanitation as we are ourselves. Professor Dudley has said "Be sure you can suggest an acceptable remedy before you condemn what is now being done. Look on both sides of the question, there may be good reason for differences of opinion."

DR. J. J. KINYOUN, of Glenolden, Pa.—Several years ago it became one of my duties to investigate the sanitary conditions of the railway coaches. I had an idea, at that time, which was shared by many others, that the railway coach and more especially the Pullman sleeping car was a veritable charnel house. I was engaged in this study at various times, during a period of two and one-half years, during which I covered over three thousand miles of travel; the greater part of this was to and from health resorts. The examinations made of these coaches were more with reference to tuberculosis than other infectious diseases. At the time when my work was suddenly brought to a close I had been able to make more than three hundred examinations of the bacteria contained in railway coaches. Of these three hundred examinations the tuberculosis bacillus was isolated in one case, and in one case an acid fast bacillus was identified in animals inoculated with the dust taken from these coaches. Sub-inoculations were negative. The dust in the air of the Pullman coach, stirred up, either by the passenger or by air currents, was found to contain but few pathogenic bacteria. The day coach contained less, and, on the other hand, the smoking car contained the largest number. The smoking car, after being in service for several hours, may be characterized without exaggeration as a veritable pig pen. Why such a condition is tolerated by the railway companies and why people who are apparently decent

in all other walks of life should be contributory to this pig pen condition is incomprehensible. My observation led me to believe that these coaches are far more dangerous, and are the disseminators of diseases in the respiratory tract.

Dr. Dudley has made some pertinent remarks with regard to the dust found in coaches. I do not believe that the dust of these coaches is usually much more dangerous than that of outside air. Careful examination made of such dust shows that 90 per cent. of it is coal dust and dirt, and is to all intents and purposes the same as found in outside air. The quantity of dust, as well as its quality, varies and is influenced in a great measure by the season or the locality. The greatest amount of dust was found in coaches running to the southern and southwestern points. This dust is admitted to be disagreeable, but aside from this feature it may be least harmful so far as it being the carrier of infectious matter.

What concerns us most is the dust contaminated with particles of matter derived from diseased persons. In order to determine just how far such dust is responsible for dissemination of diseases, samples of dust were collected from the cushions, bedding, hangings, from the interior surfaces of the coaches, and from the air. Frequently the surfaces of these gave evidence of being contaminated with inspissated sputum. This could, as a rule, be easily collected. Sometimes, however, the dried sputum was very tenacious, and was removed with difficulty. Examinations made of this material showed, in a number of instances, bacilli which, in their morphology and tinctorial properties, were identical with those of tubercle bacillus. In no instance, however, could it be isolated by inoculation into animals. I do not wish to be understood that these bacilli were not, in some instances, pathogenic. Probably they were. Many of the animals inoculated with this material died of acute septicemia, in three or four days, a time too short to see whether the tubercle bacillus was pathogenic or not. Many such examples were observed, and these, to my mind, are of so much importance that it suggested a further experimentation of this line, so that the error, if there be any, would be reduced to a minimum, but I was not permitted to do this.

Although there has been great improvement made in the manner of cleansing the railway coaches during the past seven years, my observations, made at that time, and those subsequently show that there still is room for great improvement. I note that many of the railway companies are now requiring their engineers and trainmen to have a degree of proficiency in their special duties. Some of the companies have established schools of instruction for their engineers, and demand

that these must pass an examination as to their proficiency in managing the several safety appliances before they are given charge of the train. Unfortunately no such a system applies to the cleansing of coaches. Verbal directions and printed instructions are given to the foremen by the several superintendents, who, in their turn, give verbal instructions, and are supposed to supervise the work of their subordinates. In many instances, I might say in the majority, there is not a strict personal supervision of the work of cleaning the car as seems to be required. Those of us who have had experience in the management of maritime quarantines know this, that however well an employe has been trained, the only way to insure a vessel being properly cleansed and disinfected is to have this done under your personal supervision. This same, I think, also applies but perhaps in less measure to the cleansing of the railway coach.

In many places I have observed that the cleaning is done fairly well; in others, less so, and in a few places not at all.

To give you an example, I inspected the cleaning of the coaches in St. Louis. This was soon after the introduction of the cleaning by compressed air. I asked the employe, who was a young darky, "What are you doing, John?" He replied, "Ise cleanin' dis cyar." He had all the windows and ventilators closed, one door shut, and the other open just enough to allow the air-hose to pass in. He certainly was raising a dust. I made an examination of the air, and the surfaces of the coach treated in this manner, by collecting dust from the air just before and after the alleged cleansing. The result was that there were about ten times more bacteria in the air and surfaces after than before the cleansing was begun.

The use of the vacuum process seems to me to be an advancement, but I question its efficacy for the interior of the coach in its present form. It is yet too crude. I think it will do well for carpets and cushions.

With regard to the health of the railway employes, I was treated to several surprises during my investigation of this subject. I had an idea that I would find many cases of tuberculosis among them, particularly among the Pullman conductors and porters. The data which I gathered was meagre, but so far as I went I could trace only two cases of undoubted tuberculosis occurring among the conductors and only one among railway porters. The conductors whom I interviewed had been in service over two years, many as long as fifteen years. All appeared to be in excellent health. The porters, however, are a very uncertain class. Those interviewed had only a short service, a year, or a little longer. Probably many of these had acquired tuberculosis,

and had left the service before it began to incapacitate them. I was told by many of the conductors of the Pullman service that the life of a porter was short. They usually left within a year or so, and usually for a cause. Let me illustrate what becomes of the porters: A banquet was given by the Alameda County Medical Society of California, and I had the honor to be present. A collation was served by a German, who remarked to my friend that he was going to give it in good style. As the head waiter tapped a bell in marched twenty-three sons of Ham, bearing aloft trays of viands, coming around to each chair and placing it down with a flourish, just as you have seen a Pullman porter doing in brushing off your coat. I remarked that it reminded one of being on a Pullman car. My friend remarked, "Doctor, you have hit the nail on the head, these waiters are all discharged Pullman porters, stranded here in Oakland." I must say, however, that they were a healthy looking lot.

A few words regarding the cleaning of carpets. I made the greater part of my investigation of this at Jersey City. The carpets of all the coaches were dirty; the dirtiest were, however, from the South and the Southwest. Nearly all these carpets were cleaned by the hand process, that is to say, they were taken from the car, laid on a wire rack, and beaten with a carpet beater. Some were cleaned by compressed air. These were taken into their cleaning room, laid upon the floor, and the dust blown out from the pile of carpet by the jet of air at about from fifty to seventy pounds pressure. The dust was so great in this room that it was next to impossible to see more than ten or fifteen feet. I asked an Irishman how long he had been beating and cleaning carpets. He replied, "Seven years." "Have you ever been sick?" "No." He said that his cousin had been employed with him for three years. I was rather surprised to know that this man had been employed so long, and all the time had been well. Two other employes, who had served from two to three years in the carpet room, were permitted to supervise the cleansing of cars. These two had a continued service with carpets for five years, but they had never been sick from any respiratory disease.

With regard to the drinking cup, the railways should, I think, furnish a cheap, serviceable and presentable individual drinking cup. The drinking cup, as now furnished on railways, should be abolished, and there should be substituted therefor a drinking cup which could be had for not more than one cent. There is considerable danger from the drinking cup. I believe that many cases of diphtheria are contracted in this way. I found the diphtheria germ a number of times in drinking cups and streptococci and pneumococci more fre-

quently. Children, in traveling, become restless and, if they cannot do anything else they will run every five minutes or so to get a drink.

DR. THOMAS R. CROWDER, of Chicago.— I have been much interested in the papers that have been read, and feel that I have gained some knowledge with regard to car sanitation from listening to them. I am always glad to hear this subject discussed pro and con, to hear one side as well as the other. Most of the papers I have read or heard, dealing with the subject of car sanitation, have been rather critical than suggestive. Sometimes the railroad companies, particularly the Pullman Company, which I represent in sanitary affairs, have been rather sharply taken to task for not doing what they should; but, at the same time, no one, it has seemed to me, has been able to offer any very practical suggestions for improvement. The impression has gone out amongst the men who have written on the subject that the railway companies are not taking the proper care in cleaning the cars. It seems to be generally assumed that the railway companies do not intend to clean cars as well as they can under the circumstances. That, I believe to be a mistake, and I base my belief on the fact that I have spent much time during the past six or eight months, since I have been engaged in this work for the Pullman Company, in investigating car cleaning. It is but fair to say that in some places car cleaning is not good. That depends upon a number of conditions which are not always easily controlled. For instance, upon the location of the yard. In yards adjacent to car shops, roundhouses, and such places, there is a great deal of soot, dust and dirt that cannot be considered dangerous from a sanitary point of view, yet which interferes very materially with good car cleaning. In other places the car yards may be crowded; there is not enough room to properly distribute things outside of the car, and so a number of different things may be mentioned. Nevertheless, starting some months ago without any practical knowledge of this subject the impression I have gained from an actual investigation has been a favorable one. Generally speaking, so far as the Pullman service is concerned, I believe the cars to be well cleaned.

As already stated, the impression seems to prevail among sanitarians that it is not the intention of the companies to clean the cars as well as they can. That I must deny. It is the intention to clean cars as well as possible, and in order to find out if the work is being well done by those men in whose charge it is placed, a system of inspection is carried on all the time, in order to determine whether the work is being thoroughly done. Cars must be dust-free in order to receive a favorable report from the inspector. There must be no dust in the cushions, on the ledges, on the floors or in the carpets. In the course of clean-

ing, all the dust that it is possible to remove from the car is removed. Whether this is done by the vacuum process, by air blast, or by the old-fashioned process of beating, the dust is taken out as well as it is possible to do; and, so far as I have been able to see, if one has been able to spend sufficient time on cars, it does not make a great deal of difference which process has been used; the cleaning has gone forward to about the same degree of efficiency in either case. The vacuum process is undoubtedly the best from a theoretical point of view. It removes dust from the interior of fabrics quicker than any other method, and I am inclined to believe better. When it comes to applying that process to the cleaning of a car, however, there are several things to be considered apart from the removal of dust from fabrics. By reason of the short working distance of the nozzles — only an inch or so — it is difficult to draw dust from corners and crevices about the heating pipes, along the edges, and about the seat supports. These places are gone over by hand, however, with each cleaning of whatever sort.

Dr. Bracken brought up the subject of the use of plush and other tapestries in cars and suggested the substitution of either cane or leather. I might call attention to the fact that cane is used almost entirely in the so-called tourist cars — sleeping cars of the second class, and if any one of you has ridden for a considerable distance in one of these cars, you will be able to appreciate the lack of comfort as compared with the car that is upholstered with plush. So far as I have been able to learn, there has been no acceptable substitute suggested, considering the present state of public sentiment in the matter of car interiors. I do not believe that the public is yet ready to discommode itself to the extent of making a theoretically perfect sanitary car interior. We may go on simplifying in one way or another from a sanitary point of view until we come to the simplicity of the ordinary operating room, and produce a car which is about as comfortable. The public, in the present condition of its state of mind, is not willing to accept a thing that is not comfortable. When you attempt to ride a thousand miles in twenty-four hours, on a slippery leather seat, you will assuredly become tired of it and you will in all probability pray for plush before the end of the journey.

Dr. Bracken brought up another point, namely, the practicability of the use of washable berth curtains. That is rather a new suggestion to me. It does not appeal to me as being of particular importance. Neither does the suggestion of having separate curtains for the uppers and lowers. When the upper berth is not occupied, the curtains part at its level, to leave a large triangular space. We are not going to remedy matters

by having a separate set of curtains. Whether or not it is desirable to substitute washable material for the curtain that is now in use, depends upon the liability of these curtains to become infected. If we are to believe Dr. Dudley, they are certainly not very dangerous. Dr. Kinyoun entertains a similar view of the case. It is my opinion, after some experimental investigation of the subject, that the car curtain is not a particularly dangerous thing. It has slight chance to become contaminated. The occupant comes in very slight direct contact with it.

As to the common drinking cup, it is desirable to devise a better means of distributing water than that. I would add, however, again, that we must appeal to the present condition of public sentiment in the matter. Will the public submit to the withdrawal of the common drinking cup? It is the privilege of every man who rides on a Pullman car, or a day coach, to carry with him a drinking cup for his own use; and he can have whatever kind he likes best. That privilege is extended to everybody now. A great many people take advantage of it, but the majority do not. The majority of the people are not educated in sanitary affairs. We should protect the people at all times against the possibility of infection; but it is not the business of the car companies to go into sanitary education of the public. They are to follow the lead where it is pointed out; and I am sure you will find railroad officials always ready to follow or adopt any practical suggestions and to do any reasonable thing within their power to advance the interests of the public health as soon as the public mind is educated to the point of accepting it.

As to the question of using a basin as a tooth-washing cuspidor, this matter has been brought to my attention a number of times. As sanitarians, we must look upon that as a wrong practice. As men who watch the traveling public, we may say that probably ninety-nine people in a hundred, if you built a place for them to wash their teeth, would go to the basin (as they probably do in their own homes) and wash the teeth in the same old way.

PROFESSOR WILLIAM H. BREWER, of New Haven Conn. — I would like to make a suggestion for future discussion which has not been touched upon, and that is with reference to discomfort. Comfort is hygienic. I think you will allow that of two men, the one of the two who has attended to his comforts and lived carefully, and the other has many discomforts, the one who is comfortable would on the average live longer. It is easy for us to recommend methods of correction for a danger which is, after all, but slight, but which, if adopted, would so increase the discomforts of travel that as a whole it would be a loss rather than a gain. For example, would it be more sanitary to substi-

tute cane for upholstery, as suggested? Would the traveling man live any longer? Would he travel in more comfort? Would he be any more healthy? Personally, I do not believe he would. What we might gain in the better protection against contagious diseases we might more than lose in general health. We have seen legislation directed in such a way that this was the result. Understand me, I am not arguing against sanitation.

There is one point that was not referred to, and that is with reference to scattering disease dejecta of mankind through water closets. There is some movement in that direction, but how it can be practically remedied, I do not know. In Connecticut, in certain portions of the State, the water closets on trains are locked while the train passes over certain districts, where it is claimed the water supply of the town may become infected. We scatter disease undoubtedly in that way. How can that be remedied? I merely throw these thoughts out as suggestions to be considered in the discussion on car sanitation.

DR. CHARLES O. PROBST, of Columbus, Ohio. — I want to say a few words on this subject, and, first, in regard to the water supply of our trains. We have two water supplies, one of which we are supposed to drink, and the other supply is the one that we use for lavatory purposes, for washing our hands, etc.

As to the supply of water we have to drink, suppose we have individual cups, about which a good deal has been said in the papers and in the discussion, what is the condition of the water supply that the railroad companies furnish us to drink? Have you seen them ice a train? Let us take a train that is iced from the top, as many of them are. As the train arrives at the station, a man with a tub of broken ice takes a piece of ice in his dirty hands, and throws it to the man on top of the car, whose hands are dirty, and he stuffs the ice down into the water tank below. Take the man who goes into the car with a bucketful of ice broken into lumps. With dirty hands he crowds the ice down into the tank, and from these tanks we are furnished water to drink. Let us speak for decency, as well as for protection against infectious diseases.

Take the water supply we are supposed to use for washing our hands. In the washrooms of Pullman cars, we usually find three kinds of wash-basins. They have one, which is a sort of plunger affair, in which the plug is put in the bottom of the basin, and if any of you will try to clean around that basin with a towel and see what dirt you can get on it, you will be surprised. They have another basin in which the stream of water runs in alongside of it, which I consider an improvement; but still we have a dirty basin unless we spend time in cleaning

it. They have another with a stop-cock which runs over the basin, which is the kind I prefer. I do not see any good reason why we cannot have a running stream of water to wash our hands and faces. I saw such an arrangement on one of the cars in Europe. The objection urged by railroad men is that there would be too much water used. I know, however, that one can wash his hands in a running stream and not use any more water than it would take for washing the hands in an ordinary basin, and then one could have clean water at any time. I have measured the water used in this way dozens of times and know whereof I speak.

DR. JOHN GUIERAS, of Havana, Cuba. — I wish to say a word or two in connection with mosquito bars on railroads. Mosquito bars have been introduced to comply with the requirements or demands of boards of health. These mosquito bars on Pullman cars, like many other things that are introduced for sanitary purposes, are used in a perfunctory manner. There is not sufficient inspection of these things by intelligent people who will see that the rules and regulations, based upon sanitary principles, are properly carried out. For instance, in connection with these mosquito bars you will find that a porter comes along and hangs them around the bed. He does not shake the mosquitoes out, but shuts you up with them. This is a matter that should be looked into very carefully; also the question of placing wire gauze upon the windows of cars. Boards of health require that cars passing through infected districts shall be properly screened, so that the mosquitoes cannot get in. This is frequently done; but the doors are left open, and the men in charge of the cars are not taught the importance of these things. This should be done in a perfunctory way.

DR. H. LINCOLN CHASE, of Brookline, Mass. — Dr. Kinyoun has very truly stated that there is a great deal of danger of infection from diphtheria through the common drinking cup. As a general thing, it is hard to find a hygienic drinking fountain, but in Brookline we have them in the form of jets of water in our public playgrounds and in our public schools, so that there need be no cups at all.

I would ask if the sanitarians employed by our railroad companies cannot put in similar devices in Pullman cars and other cars to protect the public health?

DR. LISTON H. MONTGOMERY, of Chicago. — There is an old adage, I believe, that "Cleanliness is next to Godliness," and I do not think very many of us will agree that the corporations spoken of in the papers quite come within this maxim of truth, or the category mentioned. While we agree in the main, as I take it, with what has been said in the papers, it does not seem that every point has been brought

out in connection with this subject. In connection with the Pullman sleeping car or the day coaches of railroad companies, it seems to me there should be a better system of flushing, and have a continuous flow of clean water from a curved faucet above the basin, instead of having the water trickle around the border of a basin as it does now. I do not recall that this point was mentioned in any of the papers.

One of the gentlemen spoke of the tourist sleeping cars. I had occasion this summer for one month or more to pass over various railroads, going to and returning from the Portland meeting of the American Medical Association, and purposely entered a number of these tourist sleeping cars. I had never seen one before, although I knew they were operated upon, as I supposed, all railways running westward out of Chicago, and I must say I never saw such filthy cars in my life. No smoking car, no day coach, or anything else that I have ever traveled in compared in filth with these so-called tourist, rattan sleeping cars.

One of the readers, in his paper, introduced another subject, namely, physical examination of railroad employes. I have examined hundreds of applicants for positions on railroads as regards their physical condition, respiration, eyesight, hearing, etc., and neither their chest measurements, respiration, or heart's action have anything to do with their duties that pertain to the sanitary portion of their work. And if they are to be promoted, they are to be examined every two or five years, or whatever the period of apprenticeship may be that they serve in one direction, before they apply or desire to be promoted. Practically, the second examination is a little more strict than the previous one. I have made physical examinations of men at intervals of a few years, after they had accepted positions as flagmen, firemen, brakemen, or as guards on elevated trains, particularly if they happen to be promoted to conductors, motormen or engineers. All these things, however, have very little to do with the sanitary arrangement of our standard or tourist sleeping cars, or of our day coaches.

DR. FRED. A. TUCKER, of Noblesville, Ind. — I am of the opinion, from what has been said, that this discussion will result in a great deal of good to car sanitation. I have made some observations along this line myself, and I find that the heartiest co-operation we get is from the railroad companies themselves. In Indiana, this summer, our State Board of Health held a conference with all railroad companies, steam and electric, operating in Indiana, and I will say that there were representatives from every road present and also the Pullman sleeping car company was represented. The greatest trouble we have in Indiana is not so much with the steam roads as with the interurban roads,

the trolleys or electric roads. By means of conferences with our state health officers and the officials of railroad companies, we will accomplish a great deal of good. These railroad men are practical; they are not theoretical. They are very anxious to get at the practical working plans by which cars can be cleaned and kept clean.

On our interurban roads we run two classes — limited cars and locals. On the limited cars they charge a little higher fee per passage, and, like our Pullman cars and day coaches, frequently they have a little better class of passengers.

The conditions that the Doctor (Dr. Montgomery) refers to in Chicago I do not think can be attributed so much to the railroad companies as to the passengers they carry. If they carry hogs, they should charge them live stock rates.

I believe it is the duty of state boards of health and of municipal boards of health to insist upon these things, and to make proper suggestions for remedying or correcting unsanitary conditions.

DR. LISTON H. MONTGOMERY, of Chicago.— In reply to the remarks of the last speaker, I wish to say that I referred to the Pacific Coast, and not to Chicago, when I spoke of the tourist cars being in a filthy condition. It is the passengers who create or make these vile conditions in the cars en route, and not that the cars were filthy when they started from Chicago.

DR. TUCKER.— I misunderstood you.

THE PRESIDENT.— I think it is fortunate that this discussion has brought out some criticisms in regard to our interurban railway traffic. I hope the readers of the papers will be as brief as possible in closing, and will confine themselves to the points brought out in the discussion.

DR. DUDLEY (closing the discussion on his part).— I will not consume very much of your time. I have listened with great interest to this discussion. Speaking for the railroads, I may say we think it legitimate and fair to point out defects, and always welcome such criticism, but, on the other hand, we cannot help feeling that it is a one-sided view of any subject to point out a defect and make a great stir over it without putting enough study on the problem to look at it from both sides. Practices may be bad, and it may be assumed that they should be abandoned or changed, but our experience has been that it is very much easier to demand a change than to say what is the best thing to do, and obviously unless the subject is covered by careful study it is entirely possible that the change may result in a worse state of affairs than the present practice. Moreover, the experience of the past has shown that there have been demands on the part of sanitarians for changes that more complete and mature study has shown to be

either not necessary or wrongly directed. I need only refer you on this latter point to the statement made years ago in regard to the relation between sewer gas and malaria. We were all taught, if I am right, that sewer gas was one of the causes of malaria, while more mature studies on this subject seem to indicate, if I am right again, that there is no relation between sewer gas and malaria. Other instances might be cited and my point is, do not make demands for changes or for the abandonment of practices until you know, by sufficient study, that there is a necessity from the sanitary standpoint for these changes, and, when this is established, make suggestions that are practicable and which will not lead to greater difficulties than the one complained of. Furthermore, if changes are needed from the æsthetic standpoint, do not urge them from the hygienic standpoint, at least until you have demonstrated that the present practices are unhygienic. It takes time and study and expense to get good practices, and, as we look at it, if a difficulty is once pointed out there is very little if anything gained by an outcry unaccompanied by suggestions for improvement.

I have made a few notes, and will remark on two or three points: First, in regard to the railroads having no sanitary bodies, except railway surgeons. It may not be generally known, but this statement is not correct, as a matter of fact. The Pennsylvania Railroad has an organization known as the "Relief Fund," which organization embraces, among other things, a corps of some thirty physicians, who are constantly studying sanitary problems in connection with the health of the employees. As a matter of fact, the Pennsylvania Railroad Company has a direct financial interest in the health of its employees, since it has entered into an agreement with its employees to the effect that if the contributions of the men and the contributions of the railroad company to the relief fund, during its normal working, do not meet the legitimate demands on the fund the railroad company will make up the difference. Some political economists have stated that this guarantee or agreement might be a very serious matter. For example, suppose an epidemic should occur, and carry off a large number of employees, so that the resources of the fund did not enable it to meet the demand. Obviously, under the agreement, the deficiency would have to be met with the railroad company, and if the epidemic was extensive enough might make a serious demand on the earnings of the road. The relief fund surgeons are accordingly constantly doing everything they can to facilitate the health of the men.

The spitting problem is one of the most difficult ones with which railroads have to contend, and although an immense amount of study

has been put on the problem we think it is a legitimate query as to whether any one knows what is the best thing to do. The spittoon is a nuisance, and there is absolutely no place for it in a car. One of the suggestions to which our studies have led us is that possibly we might get a cheap, absorbent material with which to cover the floors, which we could afford to burn at the end of the run, and then allow people to spit on the floor. However, nothing definite has been obtained along this line as yet.

As to plush, we are frank to say we think it is going to be a very hard problem to get rid of it. Plush holds the dirt, is a comfortable material to sit on, and, if we may trust our studies, there is no safer place for the dirt during the run than hidden among the hairs of which the plush is made. It stays there until we remove it later on, and we cannot help thinking that is the best place for it.

The handling of ice for the water coolers with tongs, instead of with dirty hands, is certainly a thing to be desired, and so far as our knowledge goes railroads are trying to bring this about.

We have put a good deal of study on the problem of furnishing healthy drinking water on cars. We make frequent analyses of the water supplies which are furnished to cars along the line, and have made a number of analyses of samples taken from the coolers on the cars. A rigorous effort is made to exclude bad water, and the examination of samples of water from cars shows less danger than we had feared. We have recently conducted a series of experiments on the use of copper, with the idea in mind that if the water retainers in cars could be made of metallic copper which would sterilize the water enough it would be a complete solution of the problem. These experiments are not yet completely finished.

A number of other points might be touched on, but our time is up, and perhaps enough has been said to show that your suggestions are receiving careful consideration, and that as fast as it is possible to get definite information on the subject action is being taken.

DR. BRACKEN (closing the discussion). — I will try to be brief in referring to some of the points that have been discussed.

This morning Dr. Dudley referred to the slight probability of infection from tuberculosis in cars. I quite agree with him as to the slight probability of infection, but I am not willing to go as far as he did when he stated that he considered the danger as practically non-existing. I wish to quote from one of the letters relating to car sanitation, which I recently received from a pathologist who is a careful observer, as follows:

"Sleeping cars probably deserve more criticism than some of the other railway cars. The hangings, the blankets, the upholstery of the cars, must certainly be breeding places for a large number of organisms; and I think it must be true that a great deal of infection is brought about by these means. I have in my mind the case of a gentleman who recently made a hurried trip, and in returning home developed tuberculosis of the eyelid. This I know to be a fact from microscopical examination. The circumstances surrounding the case make it almost certain that this infection was received in a sleeping car, probably from some tuberculous subject who had occupied the same berth previously."

It is difficult to prove infection in cars, but this case seems to point strongly to such a possibility.

Dr. Dudley referred to the Pennsylvania Relief organization as a body outside of the ordinary railway surgeons. I recognize the importance of this organization. As to railroads, some are better than others. We have much for which to thank the Pennsylvania Railroad Company along lines of sanitation, both for the protection of its employes and the traveling public.

Dr. Dudley said it should be a crime for an individual with a contagious disease to buy a railroad ticket and undertake a journey. It is a crime in many states for any one who has a contagious disease to expose others. It is a crime for such individuals to go into any public place, including cars, and they can be fined or imprisoned for so doing. Many states have such a law upon their statute books.

Dr. Dudley asks us to outline a remedy. Why should we? We do not pretend to be practical railroad men and we must keep in close touch with railroad officials if we are to accomplish anything. We can make suggestions, but alone we cannot lay down rules for railroad companies to follow. We must know whether our suggestions are practical. That is the reason why in a previous paper, read before another society, I did not even express an opinion as to what should be done. I simply grouped the opinions of others.

Dr. Conn spoke of the use of individual drinking cups by travelers. Such a plan would certainly be commendable. I would be perfectly willing to see every railroad company in the United States put up a notice to this effect: "No public drinking cups supplied by this company. Carry your own." But this remark of Dr. Conn's does not deal with the objection made by me to the provision of ice water only for use in the cleaning of teeth. I do not know how it is with other people, but I do know that it is a painful process to wash my own teeth with ice water.

Railway officials are ready to accept practical sanitary propositions

and the only thing for us to do is to put ourselves in touch with them if we can. This is our duty. I must say, however, that railway officials are not always advised wisely in sanitary matters, and the men who direct them into wrong channels along these lines are frequently their own railway surgeons.

"Let us be practical as sanitarians," said Dr. Conn. The advice is good and explains why we should go slowly in giving advice on matters pertaining to railway sanitation.

The statement was made that the Pullman cars are well cleaned. I believe it is the intention of the Pullman Company to have its cars well cleaned, but the thorough cleaning of cars depends largely upon the facilities and accommodations furnished for that purpose by the different railroad companies. I believe it is a fact that the Pullman Company has few, if any, car cleaning yards of its own.

The statement has been made that cane is not a good material for upholstering. This would be true for a high convex surface seat. One can, however, sit comfortably on an easy cane or willow seated chair. The chairs now frequently found in parlor coaches demonstrate that such furnishings can be used and made comfortable as seats.

As to the use of leather for upholstering car seats: I am not willing to urge the use of either cane or leather for such purpose until some practical demonstration has been made as to their efficiency. I have been in smoking cars where leather was used for upholstery, and while the seats in these cars are not always attractive to the eye, I have not found them uncomfortable to sit in. I believe there are certain railways on the Continent that are using leather in the better class of cars for upholstering seats.

Dr. Crowder does not think that railway companies should go into educational work along the lines of car sanitation. I cannot understand why the doctor should take such a position. I do not see why a railway company should not be a little in advance of the passengers it carries in matters pertaining to car sanitation. If all who travel in Pullman cars are not ladies and gentlemen they should at least be treated as such by the operators of the cars. Such treatment might have a beneficial effect in the education of travelers along sanitary lines.

Prof. Brewer referred to the care of water closets on cars. These should receive more attention. These were not mentioned in my paper, although in the argument I presented yesterday reference was made to this subject in certain of the letters read. I believe there should be some provision made for keeping the car closets open at all times. Great inconvenience may result from the temporary closing of closets

during the time that a train is passing through villages and cities in the more thickly settled sections of the country.

With reference to the closet hoppers: The choice of suitable ones is a difficult problem. Speaking as to the sanitary condition of the closet itself, the open hopper is the best; but there are many reasonable objections to its use. The most modern hoppers used in the sleeping cars are not altogether satisfactory because neither the ordinary passenger nor the ordinary porter gives it proper attention. We saw a demonstration this morning at the Boston terminal station of how closets could be properly cared for. An attendant was on duty constantly and every closet was inspected after each time it had been used. The closets were always clean and no unpleasant odors were apparent even though the so-called deodorants were not used.

While it is not possible to give as great care to car closets as to station closets, the porters could, if compelled so to do, make a great change in the sanitary condition of the closets of all passenger coaches.

Drs. Wm. H. Park and Charles Bolduan, of New York City, read a joint paper entitled "The Communicability of Cerebro-Spinal Meningitis and the Means of Controlling its Spread." (See paper, p. 359.)

DISCUSSION.

DR. HERBERT D. PEASE, of Albany, N. Y. — Mr. President: It is not my intention to enter into any detailed consideration of the literature on the subject of the communicability of cerebro-spinal meningitis, as Dr. Park has fully covered that aspect of the subject. Nor am I able to present to you the results of a series of investigations which have been fully worked out from both the bacteriological and clinical standpoints, as have been those presented by Dr. Park. The conditions surrounding the outbreaks of cerebro-spinal meningitis which I shall bring to your attention were such that if a full clinical and bacteriological investigation had been possible, the results would have been of the very greatest value, for the reason that in these outbreaks the cases occurred in comparatively isolated regions in which there existed no widespread infection such as was present in New York City. As it is, they are most suggestive, and in a large measure substantiate the conclusions drawn by Dr. Park.

The attention of the New York State Department of Health was first called to the unusual outbreak of the disease at Hopewell Junction, New York. The following is a brief outline of the cases:

The first patient was the owner and bartender of a saloon located close to the railroad junction and station. The onset of the disease

occurred on September 24th after a period of hard drinking, and he died within twenty-four hours.

The second case was in the person of a railroad fireman who had frequented the saloon owned by the first patient. This patient developed the disease on September 26th, and died on the fourth day thereafter.

The third case developed shortly after the death of the first, and was in the person of a regular boarder at the house of the first patient. He was removed to his home, some four miles away, where he died. About October 1st the six months' old child of the first patient developed the disease in a mild form and eventually recovered. An aunt of this child on returning to her home, many miles away, after nursing the child, also developed the disease, but finally recovered after a prolonged attack.

The bedding and bedroom furniture of the room occupied by the first patients were sold at auction after airing, and used by others in the village. On November 2d a boy, six years of age, was attacked by the disease and died the following day. He had associated with the members of the family of the first patient. On November 25th the young nephew of the first patient, who had been in contact with that case and his family, began to show symptoms of the disease, and died within a few hours of its onset.

No cases other than these had been present or occurred subsequently in that section of the country until five months later, when two developed. The latter cases could not be traced in any way to the previous series.

There was no question as to the clinical diagnosis in these cases, although no bacteriological examinations of the nasal secretions or cerebro-spinal fluid were made.

Through the health officer at Peekskill we were able to learn a few facts concerning the occurrence of the disease in four members of one family, the mother and three children, living in Croton-on-the-Hudson. The mother's attack developed subsequent to those of one or more of the children, and she was brought to Peekskill Hospital. I have been unable to obtain any further information concerning the time, course and termination of the disease in the children, but the mother had cerebro-spinal meningitis without question, and died from it.

Through the health officer of Highland Falls, we obtained the histories of two children, brother and sister, who were the only persons who had the disease in that locality during the year. The children's grandmother returned home after spending the winter in Waterbury, Conn., where the disease was prevalent. She brought clothing for the

children. The sister developed the disease four days after its onset in the brother. The diagnosis of cerebro-spinal meningitis was undoubtedly correct in both instances. These cases were closely quarantined.

The fourth series, consisting of three cases, were the only cases which occurred during the year in the small village of Kiskatoni, near Catskill. The first two patients were brothers, and the third was their nurse. The disease developed on the 20th, 23d, and 25th of March, respectively. The diagnosis was unquestionable from a clinical standpoint.

The fifth series was made up by three cases of the disease in one family in the village of Scotia. The disease also occurred in that village in one or two other isolated instances not connected, so far as known, with the first series. These three cases developed on the 16th, 18th, and 22d days of February. The pathological findings and the bacteriological examination at autopsy confirmed the clinical diagnosis in one of the three cases.

On May 11th a child was sent from its home in Oneida to visit its grandparents in Ilion. On the 13th of May, symptoms of cerebro-spinal meningitis developed, and the child died the next day. On the 18th of May another child in the Oneida home of the first child developed the disease and likewise died within twenty-four hours. There were five other cases in the village of Oneida, but they were not known to be connected with these other two cases.

In the village of Ransomville, near Niagara Falls, four cases have occurred in one family. The father developed the disease on the 19th of April, the oldest son on the 21st of April, a few hours after the father's death, the sons' nurse on May 1st, ten days after coming from Niagara Falls to the house, and a younger son on the fourth of May. No other cases occurred before or developed later in that village.

Isolated cases were reported as occurring in several of the smaller cities of the State. Thus the cities of Hudson, Niagara Falls and Rome had but one each, Binghamton 3, and Peekskill 3. In the larger cities the disease was practically epidemic.

The existence of so many series of cases in each of which the contact between the individuals contracting the disease was close, with no other cases occurring in these sections of the country, would seem to strongly indicate the transmission of the infective agent from person to person by such contact. Such a method of transmission is most strongly indicated by the development of the disease in the two nurses a few days after the commencement of their attendance upon those who were suffering from the disease. If, therefore, transmission by contact is not only possible but probable, the conclusion is warranted that well persons should not unnecessarily come in contact with cases of cerebro-

spinal meningitis, and that houses in which such cases exist might well be quarantined, especially if the cases in them are not isolated.

In considering the well-recognized fact that large numbers of well persons have very commonly come into close contact with cases of the disease without contracting it, it should not be forgotten that the history of the disease shows clearly that the development of a special susceptibility, usually brought on by physical or mental strains and excesses or exposures, almost invariably precedes the onset of the attack. The lack of this susceptibility does not preclude the possibility of such persons harboring the meningococcus in their nasal secretions, as has been demonstrated by Dr. Park, and thus becoming a menace to other well persons who come in contact with them and who are susceptible. On this ground rests the advisability of quarantining cases of the disease, and those in attendance upon them.

DR. JUAN BRENA, of Mexico City, addressed the Association in Spanish. His remarks, as interpreted by Dr. Juan Guiteras, are as follows: I admit that cerebro-spinal meningitis is a transmissible and highly contagious disease, and that it is transmitted by discharges from the nose, and measures should be taken to prevent its transmission from the discharges from the nose. I recognize the fact that the meningococcus has been found in different epidemics in the United States, and I refer especially to the investigations that have been made here in the State of Massachusetts.

I would like to know whether the sporadic cases of cerebro-spinal meningitis are of the same nature as the epidemic cases. I wish to call attention to the fact that frequently we had several sporadic cases without extensive spread of the disease. Are the sporadic cases capable of transmitting infection? Do they give rise to secondary cases? That is a question I would like to have settled. Again, I would call attention to the fact that cases in England have been reported where there has been no epidemic, but simply one sporadic case, and from that a few other cases have been traced.

I have had no experience with epidemic cerebro-spinal meningitis, as this disease does not appear in Mexico; we are only familiar with the sporadic cases of the disease. Is the organism the same in these two different groups? May not the sporadic cases be accounted for by pneumococcus infection, and not by meningococcus infection? I would call attention to a certain similarity between the two infections, pneumonia and meningitis. I notice certain differences, especially that pneumonia is more prone to affect adults, whereas cerebro-spinal meningitis is largely a disease of the young.

DR. PARK (closing the discussion.) — As to the organism, some of

you doubtless remember that the meningococcus was first described by Weichselbaum from a sporadic case. The first six cases were sporadic, not epidemic, and he hardly knew at that time whether the epidemic cases were the same as the sporadic. Reversing the question, I think there can be no question that many of the sporadic cases are due to the meningococcus. Where there have been quite a number of cases of pneumonia and bronchitis, there are apt to be a certain number of pneumococcic cases, and from my observations there were two or three cases in which streptococci were found present, with typical symptoms, with no bacteriological diagnosis and no evidence of their not being of a meningococcic nature. It is pretty well determined that in some of the sporadic cases the meningococcus is primary, and the pneumococcus secondary; in some other cases there will be found streptococci, and in others staphylococci.

As to whether the sporadic cases are communicable or not, that is a matter of observation. A few cases have been and many others have not been, so far as known. Secondary cases afford information. I think we all admit that during times of epidemics bacteria frequently have a certain increased ability to cause disease. What this change is, we do not clearly know, except that the bacteria take hold and propagate more readily when transmitted from case to case. The more cases the larger is the soil which grows and disseminates the bacterial seed of disease.

On motion of Dr. Henry D. Holton, the following papers were read by title, and ordered published in the proceedings: "The Restriction of Contagious Diseases in the City," by Dr. Chas. V. Chapin, of Providence, R. I.; "Quarantine, The Delirium Ferox of American Sanitation," by Dr. John S. Fulton, of Baltimore, Md.; "Modification of Present Port Inspection," by Dr. A. H. Doty, of New York City.

On motion, the Association then adjourned until Thursday morning, at 10 o'clock.

SEPTEMBER 28 — THIRD DAY.

MORNING SESSION.

The Association met at 10:15 A. M., and was called to order by the President.

Several announcements were made by Dr. Durgin, Chairman of the Local Committee of Arrangements, in regard to trips and entertainments previously mentioned.

The Treasurer, Dr. Frank W. Wright, of New Haven, Conn., submitted his annual report, as follows:

TREASURER'S REPORT.

FRANK W. WRIGHT, TREASURER, IN ACCOUNT WITH AMERICAN PUBLIC HEALTH ASSOCIATION.

1904.		RECEIPTS.	
Dec.	31.	Cash on hand.....	\$1,572 03
		Collected for dues for 1902.....	15 00
		Collected for dues for 1903.....	75 00
		Collected for dues for 1904.....	2,070 00
		Collected for dues for 1905.....	45 00
		Sale of Transactions.....	106 10
Total			\$3,883 13

1905.		DISBURSEMENTS.	
Feb.	10.	By cash paid F. W. Wright, (Order No. 163).....	\$200 00
	11.	By cash paid C. O. Probst, (Order No. 164).....	230 00
	11.	By cash paid H. D. Pease, (Order No. 165).....	43 42
May	1.	By cash paid F. C. McElroy, (Order No. 166).....	18 75
	1.	By cash paid F. J. Heer, (Order No. 167).....	22 50
	1.	By cash paid R. S. Weston, (Order No. 168).....	19 85
	1.	By cash paid U. S. Express Co., (Order No. 169).....	6 39
	1.	By cash paid Wm. Whitford, (Order No. 170).....	228 25
	1.	By cash paid Cent. O. Paper Co., (Order No. 171).....	7 90
	1.	By cash paid Isennagle-Berry Co., (Order No. 172).....	65 00
	1.	By cash paid R. C. Crowl Co., (Order No. 173).....	4 25
	1.	By cash paid Engelke & Bigelow, (Order No. 174).....	110 76
	1.	By cash paid H. D. Holton, (Order No. 175).....	43 61
	1.	By cash paid G. C. Whipple, (Order No. 176).....	75 00
	24.	By cash paid O. G. Brooks, (Order No. 177).....	35 00
	24.	By cash paid E. T. Williamson, (Order No. 178).....	38 20
Aug.	21.	By cash paid Bucher Eng. & Mf. Co., (Order No. 179).....	10 40
	21.	By cash paid Engelke & Bigelow, (Order No. 180).....	5 90
	22.	By cash paid C. O. Probst, (Order No. 181).....	275 00
Sept.	11.	By cash paid F. W. Wright, (Order No. 182).....	10 00
	13.	By cash paid F. J. Heer, (Order No. 183).....	50 00
	13.	By cash paid Journal Inf. Dis., (Order No. 184).....	420 00
	13.	By cash paid C. H. Weber, (Order No. 185).....	14 03
	20.	By cash on hand.....	1,948 92
Total			\$3,883 13

THE PRESIDENT.—What disposition will you make of the Treasurer's report?

DR. HENRY D. HOLTON.—I move that the report of the Treasurer be referred to an Auditing Committee to report at this meeting. Seconded and carried.

THE PRESIDENT.—I will appoint as Auditing Committee Drs. Henry D. Holton, Gardner T. Swarts, and G. P. Conn.

The Secretary read invitations from Chicago, Denver, Montreal, Memphis, and Nashville, inviting the Association to hold its next meeting in those cities. He said these invitations would be referred to the Advisory Council.

The Secretary called the roll of the Advisory Council.

Dr. J. Ewing Mears, of Philadelphia, presented the following resolution, which was referred to the Executive Committee:

WHEREAS, The American Public Health Association believes that the promotion of public health, and the removal of those conditions which menace it, can be most effectually accomplished through the intelligent co-operation of the general public; be it, therefore,

Resolved, That the Association earnestly recommends that courses of instruction in sanitary science be established, and be made to form an essential part of the instruction in the schools and colleges in the country.

In the symposium on method of securing more uniform instruction and coöperation in health work, the following papers were read:

(a) "Educational Coöperation with the General Public in Public Health Work," by Professor F. C. Robinson, of Brunswick, Maine.

(b) "Graduate and Undergraduate Instruction in Hygiene in Universities and Medical Colleges; Special Diplomas in Public Health," by Professor H. C. Ernst, of Boston, Mass., and by Dr. George J. Adami, of Montreal, Canada.

(c) "Teaching of Hygiene in the Elementary Schools," by Dr. M. Marquez, of Chihuahua, Mexico.

(d) "Present Regulations of Laws as to Qualifications and Methods of Appointment of (a) Executive, and (b) Technical Health Officers," by Dr. Samuel H. Durgin, of Boston, Mass.

(e) "Laws Concerning the Teaching of Hygiene," by Dr. Helen C. Putnam, of Providence, R. I.

(f) "The Work of the Health Education League of Boston," by Dr. Henry J. Barnes, of Boston, Mass.

(g) "Sanitary Conferences and Schools of Instruction for Health Officers," by Dr. Herbert D. Pease, of Albany, N. Y.

(h) "Readjustment of Education and Research in Hygiene and Sanitation," by Prof. W. T. Sedgwick, of Boston, Mass. (See papers, pages 115-157.)

The following paper by Dr. Emilio Bonillo, Mexico, was read by title: "Methods to Secure Better Instruction and Coöperation in Public Health Matters by Teaching Hygiene to School Children." (See paper, page 161.)

DISCUSSION.

DR. C. A. HARPER, of Madison, Wisconsin.—Mr. President, Ladies and Gentlemen:—The papers have been so interesting and, I might say, numerous upon this subject, that I shall not endeavor to take up the discussion of each paper. In fact, I do not possess the ability to do

so, because they go into conditions that are deeper than those I have come in contact with, and are a little foreign, perhaps, to my work along the lines of sanitary measures.

There is no doubt that public interest is being shown in regard to new fields of sanitary science and hygiene. The people are awakening thoroughly to the situation. This is emphatically shown from the way in which the tuberculosis wave has swept over this country within the last few years. Appropriations are now being made by legislators to bring about various sanitary reforms to protect against the spread of this disease. We have in this measure popular sentiment with us. It is essential in all lines of sanitary science and hygiene to get with us the public sentiment. Professor Sedgwick just made a statement in his paper that there was very little inducement for people to go into a deep study of the sanitary sciences, because the field of operation and compensation is limited at the present time. That, I think, is lamentably true, but if we can instill into the minds of the general public the necessity of the sanitary sciences and their development, then we can create on the part of that public a feeling to pay larger salaries, thus making these positions worthy of any man's time to fill. Until we do that it will be impossible, I believe, in the practical fields to get men to study and expect them to remain in positions for any considerable period of time, and especially so as long as the political field is so closely associated with the scientific working of facts now before us. When the political situation becomes disassociated from sanitary and hygienic measures; when these positions can be made of long standing and well compensated, then we will have men and women capable of doing that which we most ardently demand. Instead of beginning entirely with our universities, medical schools, and colleges of letters, etc., I believe the teaching of certain branches of sanitary science and hygiene must begin also in the smaller institutions of the country, in order to create that healthy sentiment which is really demanded. Those people who are more or less ignorant as the result of limited educational facilities are the people we have to contend with. We must reach them in some way before we can bring about that popular sentiment which will create positions that will tempt young men, and until we can do that in some manner or form, we are going to grope in the dark — go spasmodically in the development of those things that are so essential and important to the preservation of our citizens. If we can measure a life in dollars and cents, as we can measure the value of an animal, and place that before the people squarely on an economic basis, then we will make a start which, if continued, will reach any desired end that we may demand.

DR. F. F. WESBROOK, Minneapolis, Minn. — The education of every class and stratum of society seems to be the dominant note which has been struck. Prof. Robinson, in introducing the subject, has laid particular stress upon this matter and has called attention to the accumulated masses of misinformation which are encountered on every hand and which must be removed. Our morning's program calls attention to various methods of accomplishing this. Dr. Barnes has shown how it is possible to reach the adult working class. Although he seems to be doubtful of his ability to show definite results, it is perhaps possible that the efficient boards of health of Boston and of the State of Massachusetts, which we all endeavor to emulate, are developed because the matter of educating the public in this section of the country has been so thoroughly attained. I think it is more than possible, in fact that this is the probable explanation of the successful board of health work in Boston and Massachusetts. Dr. Putnam has shown, what is to my mind, one of the most important means of disseminating information; that is, through schools. There is, however, one question which has to be met in teaching hygiene to school children, and that is, the determination of what is to be taught to the children. This phase of the question is dealt with in a slipshod fashion throughout the whole country. Prof. Robinson's reference to the acquirement of immunity to pernicious and "crank" notions in regard to public and private health, shows that the immunization process is a gradual one, and that during the acquirement of immunity, many others may be infected with similar dangerous views. It is very important that some responsible body be charged with the duty of preparing the material and supervising its teaching to the children who may be very greatly harmed throughout their whole lives by misinformation acquired in early life.

The points brought out by Prof. Ernst are extremely practical. Last evening in my address to you, I endeavored to show certain of the responsibilities of this American Public Health Association, which contains men of the highest reputation in every branch of sanitary service. Although it is an international association, there seems to be no impropriety in the examination by the Association of the qualifications of those who are anxious of holding sanitary posts. Whilst different localities may not be willing to accept per se, the diploma of the Association, the examination should be of such character and the diploma so difficult to attain, that gradually all localities in all of the countries represented, would be willing to accept the diploma as a qualification for the individual to engage in public sanitary work in that locality.

If such work can be undertaken by this Association, it will help to solve one of the difficulties under which we at present operate; namely,

that of the close limitation of our funds. If such diplomas could be conferred by this Association, it would appear to be quite justifiable to ask the federal authorities of the different countries represented, to help us in a financial way, since we should be protecting their best interests. The matter brought forward by Dr. Pease is in direct line with this too. In order that correct teaching reach the public, it must begin with those who are charged with the duty of preserving the public health and through the medical profession and the various local boards of health gradually reach the public. This education must be given school children and to adults who never have had the opportunity as school children, to receive the proper information. By the publication of a journal our Association can prepare the most scientific sanitary truths in popular abstract form to supply to others. In this way, state boards of health could obtain material already set up, which could be included with their periodical sanitary bulletins and the local information and results of work could be incorporated or added. A proper function of this Association would be to supply what might be termed "patent insides" of the most scientific and valuable sanitary information for the state and local boards of health as a part of their publications. This would afford another opportunity of augmenting our funds.

With reference to the paper presented by Prof. Adami, I wish to say that I owe him an apology because I was not more specific when I asked him to contribute a paper to this meeting. I am glad, however, that I failed to be more specific, since he, as an outsider, has discussed the methods employed in the United States and contrasted them with the English methods, modifying, most ably, the English methods to suit American needs. What he has said is most valuable. Even if it is not feasible for this Association to be an examining body for the United States, for Canada or for all of the countries represented, it might be possible at least for it to operate in the United States so as to coöperate with the state boards of health and the universities. In this way the state boards of health might serve as the examining bodies to determine the qualifications of those who are to receive the diploma of public health and to grant it. State universities or universities like Harvard, or institutions like the Massachusetts Institute of Technology, could give instructions in public health matters and sanitary science, leaving the state boards of health to conduct the examinations and grant the diplomas. Prof. Ernst's suggestion that our Association serve as the examining and degree conferring body is perhaps more desirable and less complicated.

The crux of the whole matter, so far as sanitarians are concerned, is the lack of pay. Prof. Sedgwick has emphasized this point, and it

is apparent that no man wishes to spend four years in a university, four years in a medical college and two or three years in sanitary work, making a total of from seven to ten or twelve years' study after he leaves the public school and involving considerable expense and great effort in order ultimately to qualify for a position for which there seems to be as yet, little demand. More particularly is this true when even the best positions are temporary and are likely to be lost sooner or later on account of political preferment. Education of the masses in regard to scientific facts which underlie the conservation of the public health is what we need.

DR. H. LINCOLN CHASE, of Brookline, Mass. — I will only take a minute or so of the time of the Association to say a few words on these subjects. As President Wesbrook so well said, the education or enlightenment of every stratum of society is essential to successful attainment of the ideals of this Association. It is true, it is difficult to know just where to begin in this work. We have begun in Brookline by teaching teachers how to instruct the children in the prevention of diseases and build up health. The health department co-operates with the school department very closely. Ten years ago we started our medical inspection of school pupils, which has continued ever since. Two or three years ago we prepared a brief circular which was issued to the teachers, and during the past summer we revised it. This circular enables the teachers to instruct the children from the kindergarten grades up to the high school grades as to personal cleanliness and other details essential to health. I will not take time to read this circular, a copy of which I have in my hand, but will hand it to the Secretary as a part of the remarks I was going to make, and to invite all of you to take a copy of the circular with you.

The following is a copy of the circular :

PERSONAL CLEANLINESS AND THE PREVENTION OF DISEASE.

To the Teachers of the Brookline Public Schools: — "Your attention is again called to the need of teaching personal cleanliness and to certain other measures that tend to prevent the spread of communicable disease among school children. It is known that children who are very slightly ill, or even not ill at all, may be infected with dangerous communicable disease. Such children often mingle freely with others, and are, according to our present knowledge, the most frequent cause of the spread among children of infectious diseases. All teachers should know the fact, that light cases of these diseases not infrequently cause severe and even fatal cases. If communication between mouth and mouth can be

prevented, it is believed that communicable disease can be very considerably diminished. The schools are certainly the proper places for inculcating that personal neatness and personal cleanliness which would forbid the passage directly or indirectly from mouth to mouth of any article.

"The free text book system presents certain obstacles to the development of the idea of privacy of personal property, but with care these obstacles can be overcome. Even with this system the pupil can have his book and pencils for a term or a year, and be held responsible for their condition. This should always be done as far as possible with everything that is furnished by the school department for the use of pupils. It entails a little more trouble for the teachers, particularly in the care of pencils and certain other small articles; but with a proper system and some care these can and must be kept separate for each child. When books become soiled, they must be either cleaned or burned. The drinking cup used in common is perhaps the most frequent means of transmitting saliva and infection from one child to another, and its use must not be allowed. Separate drinking cups must be provided either by the parents of the pupils or by the school department, until hygienic drinking fountains, requiring no cup and already in use in nine of our thirteen schools, have been introduced into all. It must be remembered that the germs of some of the commonest and also of some of the most dangerous diseases are frequently contained in the mouth. In such cases anything moistened by the saliva of the infected person, may, if it touches the lips of another, convey disease. The more direct the contact, the greater the danger. It is the purpose of health officials to keep in isolation all persons who have communicable disease during the time that they are infectious, but in many cases this is wholly impracticable, if not impossible. Little restraint oftentimes is put on light cases of measles, whooping cough, chickenpox and mumps, and even such diseases as diphtheria, scarlet fever, smallpox and consumption are in certain cases so mild as to be unnoticed, so that children affected with them continue in school. Since in such cases one of the chief vehicles of contagion is the secretions of the mouth and nose, much can be done to prevent contagion by teaching habits of cleanliness and by the strict prevention of close contact of the children with each other, and prevention also of the use in common of articles liable to become infected.

"The practice found in some kindergartens of having the children sit with their little chairs in actual contact must not be permitted; there should always be an interval of at least a foot between the chairs, and in time of threatened epidemic a greater interval. The practice also

of having kindergarten children — the very ones most susceptible to contagious diseases — use in common, without previous disinfection, various little articles that are liable to become infected, must not be allowed. While considering cleanliness, the need of clean air in the school room must not be forgotten. Clean, pure air tends to promote both mental and physical well-being, and consequently resistance to disease. To this end proper ventilation of the school room and a cleanly condition of the persons and clothing of the thirty or more children in the room must be constantly maintained. A copy of this circular will be furnished the teacher of each room in all the schools, and must be preserved by each teacher for reference. A placard containing the rules for pupils given on the last page will also be furnished each school room except in the high school and the kindergartens. The placard is to be posted in some place in each room where the pupils may conveniently read it. Without the intelligent and faithful coöperation of all the teachers the efforts of the health department will not avail to make our school rooms as healthful and safe places of resort for our children as they can and should be made.

Placard: —

CHILDREN MUST BE TAUGHT

Not to spit except when they have a cold; then if outdoors, spit into the gutter; if indoors, spit into small pieces of old cloth, (carried for the purpose) which should be burned after use.

Not to put the fingers into the mouth; use a tooth pick if needed.

Not to pick the nose; always carry a handkerchief.

Not to wet the fingers with saliva in turning the leaves of books, or in handling cards.

Not to put pencils in the mouth, or moisten the point with the lips; keep the point well sharpened.

Not to wipe pens on the hair.

Not to put pens into the mouth.

Not to put anything into the mouth except food and drink.

Not to "swap" candy, chewing gum, half-eaten food, whistles or bean blowers, or anything that is habitually put into the mouth.

Not to kiss upon the lips; kiss the forehead or cheeks.

Not to allow the finger nails to become long or unclean, or the teeth to be neglected.

Not to face toward another person when coughing or sneezing.

It is respectfully requested that all teachers and pupils carefully read and become familiar with the above rules, and teachers are charged faithfully to enforce them.

PROFESSOR W. T. SEDGWICK, of Boston, Mass. — In addition to what was said in my paper, I wish to mention one means of public education that has not been touched upon. There is now in Germany the most remarkable public health and contagious and infectious disease exhibition that has ever been seen. It was set up first in Dresden, where it attracted over two hundred thousand visitors. Then, for a few weeks, the exhibition was given at Frankfurt, and it is now in Munich. I found it so crowded that it was hard to get in. I will not stop to explain it in detail. It is the gift of a rich manufacturer in Germany, and this exhibition is being moved from city to city. I wish very much we could have it set up in our large cities, such as Boston, New York, Chicago, etc. There is a display of all the ordinary germs, and I might say the extraordinary germs, too. There is a magnificent display both of pathogenic and some of the harmless germs. There is a series of rooms devoted, one to tuberculosis; another to typhoid fever and Asiatic cholera; a third to diseases of children and the like; a fourth to leprosy, plague, and hydrophobia; a fifth to diseases of the army; a sixth to disinfection, etc. It is a magnificent and most interesting exhibition. It is largely a matter of philanthropy. It is the finest thing of its kind I have ever seen, and I do not hesitate to say, that it is the best educator of the people I have ever seen. Five or six thousand people a day were visiting it while I was there; they had to wait in order to get in.

Before sitting down, I want to say also this,— that we have got to begin at the bottom. We may take a long time to educate the people along certain lines; but it must be distinctly and thoroughly understood that the time has gone by when the proper constitution of a board of health is that which makes it consist of a political doctor, a political nobody or two, and others who know nothing, or next to nothing, about the nature of infection, infective processes, and sanitary science. It may just as well be definitely understood that this Association does not countenance that sort of thing. We want to get good boards of health, and as members of them men who are informed and broad-minded, men capable of instructing the authorities, state and federal, what to do, and board of health positions should be held in such high esteem that they will attract men of great ability. Positions on boards of health should be well paid, non-political positions. When once that condition is established, we shall have good men seeking them. We should discourage cheap boards of health, cheaply manned. Let us state plainly that the composition of boards of health is generally wrong; that in our cities and towns they are not made up as they should be; that the positions are not filled by experts, not filled by the most intelligent people in the community, and that too often these positions are used for political

purposes. And then let us urge a change for the better. Let us insist on better boards of health, better manned, free from political influence of any kind and with sure tenure of office for all employes during good behavior, with promotion in prospect for marked efficiency.

THE PRESIDENT.— We will now listen to the report of the Auditing Committee.

DR. HENRY D. HOLTON. — Your auditing Committee begs leave to report that the books and vouchers of the Treasurer have been carefully examined and found correct. The books are kept in a businesslike manner, so that at any time the accounts of the Treasurer with the Association can be readily determined.

(Signed) HENRY D. HOLTON,
GARDNER T. SWARTS,
G. P. CONN,
Auditing Committee.

THE PRESIDENT.— What will you do with this report?

DR. LISTON H. MONTGOMERY.— I move that the report be adopted and approved. Seconded and carried.

On motion, the Association adjourned until 3:30 P. M.

THIRD DAY — AFTERNOON SESSION.

The Association reassembled at 3:30 P. M., and was called to order by the President.

The first in order was a volunteer discussion on military hygiene, under the following heads:

- (A) HYGIENIC INSTRUCTION OF ARMY MEDICAL OFFICERS; (B) THEIR POWERS AND DUTIES; (C) NEEDED IMPROVEMENTS; (D) CAMP SANITATION; AND (E) SANITATION OF AN ARMY EN ROUTE.

GEN. A. A. WOODHULL, of Princeton, N. J.— As the President has stated, I did not come prepared to make an address, nor do I think it was his desire that I should present a formal paper; but after forty years of military service you may believe that I am interested in and thoroughly saturated with this subject. But inasmuch as it is very broad and the time is limited, I can only speak briefly upon a few points. As public comment upon military matters by a military officer is unbecoming, for it is against the genius of the service to engage in newspaper criticism, I shall be obliged to reporters for the daily press if they will kindly omit my remarks from their notes. But I am per-

fectly willing to talk over these conditions in a confidential way among ourselves, with the view of explaining some of the many difficulties that embarrass this branch of the public service. And it will be more convenient to consider as a whole the various topics suggested rather than to divide them into sections, for the ten minutes allotted me will at the best go but a very short way toward their elucidation.

I have no doubt the subject has been designated for consideration because of the remarkable contrast that is alleged to exist, and I believe really does exist, between the conditions in the army of Japan in its offensive campaigns against Russia and the prodigious disability from disease (with the consecutive mortality) in our domestic camps during the Spanish-American war, to say nothing of the physical and administrative situations in Cuba and elsewhere. The contrast is not only marked, but in many respects it is very shocking. I may say in passing, however, that according to my best knowledge the Russian troops displayed a freedom from typhoid fever similar to that enjoyed by the Japanese. I suspect that this is due to two causes: (1) The habitual drinking in the form of tea or soup of boiled instead of raw water, and (2) the possible immunity enjoyed by the survivors of those who had incurred this fever in childhood, or later in civil life. I do not affirm this (from insufficient knowledge), but suggest its possibility. Some students think there may be a natural insusceptibility to enteric fever, amounting to practical although not absolute immunity in all the Oriental races, among whom would be included at least the Asiatic Russians.

Practically the whole instruction of medical officers in military hygiene, the first point suggested, occurs within the service. As you all know, candidates for permanent commissions are only accepted after an impartial and very thorough examination. From personal experience upon examining boards, I can say that where any instruction in hygiene is given students in the medical schools it is most superficial, and that military hygiene is practically (perhaps necessarily) overlooked. After they have shown their general medical knowledge, with an outline of hygiene, the approved candidates are required to attend the army medical school in Washington for six months, after which they are re-examined before being actually commissioned. The theory of military hygiene, including laboratory work, is a prominent and important feature of that instruction; but its practical application is acquired in the camps and garrisons themselves.

A great deal of such knowledge is thus absorbed by observation and practice — usually under senior officers — among the troops. All regular medical officers are carefully, not perfunctorily, re-examined

before further promotion, and in those examinations for the grades of captain and major much stress is laid upon this form of preventive medicine, upon the care of troops. As a matter of course this training cannot be applied to the medical officers who go out with the volunteer troops, who necessarily make up the great mass of our armies in active war. Those gentlemen come out, as probably nine out of ten of you would be, absolutely ignorant of the circumstances of camp life, of the conditions of the field, and of the precautions necessary to preserve the health of the troops, who in turn are themselves as ignorant in such matters as children and, worse than children, are headstrong and impatient of the required restraint. Many of the conditions developed in camp are wholly unknown in civil life, and it is a grave misfortune that they are not apprehended by those from whom intelligent and preventive guidance should be expected, until their effects are seen.

A bill before Congress, if enacted, will add a reserve of medical officers who after examination will remain in civil life but, should they consent when the emergency arises, will be available for service with the new levies. These examinations would hold good for a term of years, and would guarantee at least fair professional knowledge for the medical officers of volunteers, but in the nature of the case they cannot be expected to be practical military hygienists.

There is much popular misapprehension as to the duties of medical officers of the army, their authority in connection with troops, and what may reasonably be expected of them. The impression seems to prevail that the medical officers of the Japanese army have more authority than those of the United States army. I think that is a mistake. In any military body, large or small, there can be only one head. One man must be responsible. If he is a wise man he will follow the advice Jethro gave to his son-in-law, Moses,* and will delegate his authority to certain subordinates, reserving for himself an ultimate decision, either on appeal or by original action. If he is not a wise man, he will assume universal knowledge and will attempt to exercise his authority directly, even in matters of small detail. I have known both kinds. But no man, whatever his rank or his capacity for general command, can pursue the latter course without detriment to those under him. The efficient commanding officer, whether of a garrison of a few companies or of an army of many divisions, will delegate appropriate duties to the officers of his staff and to the inferior generals, reserving final authority to himself. If he finds the staff officer incompetent, he should relieve him. In order to be an efficient commanding officer, one must have a good opinion of him-

*Exodus, xviii, 21.

self; self-confidence is an essential military quality. But he should have no such confidence as to believe that he is infallible over the whole range of action. When he does think that, and acts on it, the frailty of the human machine is displayed. So, the commanding officer must be respected until, having demonstrated his folly and inability, he gives place to a successor. But it is impossible, as sometimes suggested, for a medical officer to be clothed by the President or by Congress with absolute and inherent power to follow his own judgment in relation to camp sanitation, to the duties of troops, to their care and assignment, because that would go to the other extreme. If I, for example, had such authority with an army in the field, I might designate this, that, or the other regiment to be moved from an unwholesome position, or I might even send away troops that in my judgment would be healthier elsewhere. Carried to its logical extreme I might, while acting in perfectly good faith but with imperfect judgment, absolutely deplete the forces in the field. In that case the troops would be serving two masters. It is not easy to determine by regulation exactly how far the positive power of the staff officer should go. As a matter of fact, I do not think that medical officers of mature experience are apt to ask unreasonable things; but it may happen that, not acquainted with the plan of campaign, some one may insist upon impossibilities. The essentials are: (1) That the senior medical officers shall have competent knowledge beyond that of the practice of medicine to know what may be done, and sufficient intelligence and tact to present the conditions and the methods of relief clearly before the commanding generals; and (2) that the commanding officers themselves should have enough common-sense to follow good advice. I may be pardoned, perhaps, for saying that I think the former condition is fulfilled more frequently than the latter. A happy illustration of the union of good advice and intelligent acceptance of it is the campaign against yellow fever at Havana. General Wood appreciated Walter Reed's demonstration of the mode of transmission of that disease, and authorized Havard and Gorgas vigorously to put in practice their recommendations. It would manifestly have been impossible for the medical director, in opposition to the commanding general, or even without his military support, to have assumed the disinfection of Havana. On the contrary, I could readily name general officers who, I am sure, would have seen nothing but folly and extravagance in the proposition to suppress an immemorial disease by the annihilation of the ubiquitous insect. It is within my knowledge that when it seemed necessary to send from the field victims of mental disease, the commanding general not only required nominal lists of such patients, with

their special diagnosis and the time they had been treated, to be submitted to him for his personal information — which was clearly within his authority if he distrusted the medical director's discretion — but he also exercised that authority by striking from the list, with no additional information than his reading of them afforded, the names of men whose condition as he interpreted the diagnosis did not seem to him to require such relief. That was clearly a case of incompetence in that particular combined with unwillingness to ask or to follow expert advice. Unfortunately it too frequently happens that general officers fail to recognize medical officers in the higher grades to be quite as trustworthy and competent in their particular spheres as are engineers or quartermasters in theirs, sometimes ignore them in arranging for the future, and sometimes over-ride their opinion in administering the present.

Just how this evil is to be corrected is an open question. I doubt whether a civilian body is competent to discuss this phase of the subject. I do not see how it is possible or desirable by legislation to give the medical officer a position intrinsically independent of the commanding officer, any more than any other staff officer can be absolutely independent. But it is perfectly possible to clothe the medical officer with the commanding general's authority and to authorize him to issue orders within a certain sphere "by command of, etc." Most, but not the broadest-minded, generals shrink from that. I think the best results are to be obtained by a campaign of education for medical officers and commanding officers alike. For years I have contended within the service that medical officers must take their military duties seriously, that they must carefully study, not strategy nor engineering, but the common every-day duties of troops. They must be familiar with all that is required of enlisted men in peace and in war; and, as a consequence, the more familiar they are with these matters the more respect their opinion will receive. Commanding officers, in turn, must be led to recognize their medical officers as more than mere doctors whose sole province is with the disabled. They must learn to regard them as important, intelligent and loyal auxiliaries, whose opinions are given in good faith and are to be respected. As the study of military hygiene progresses in the line of the army (and it is required now to be taught at West Point and in other military schools) the line officers will gradually recognize that there is such a special field of military science in which there are experts whose opinion is to be respected. The civil profession and the general public can aid in the good work, not by unreasoning censure but by intelligent inquiry why there is unusual sickness and by asking what recommendations the

medical department has made and what action has been taken on them. No medical department is impeccable, but it is much more frequently sinned against than sinning. The part of the public, as it seems to me, is to apply a reasonable pressure upon the commanders, so that they may understand that something more than winning battles is expected of them.

In point of fact, the existing regulations give to the medical officer a good deal of initiative. For a number of years he has been required to make a careful monthly inspection of his command. There is not a mere formal matter, but there are numerous items upon which he must express an opinion and make recommendations to the commanding officer, who is the one, as has been explained, upon whom rests the responsibility and upon whom devolves the duty of execution. The commanding officer enters upon the paper his views, either approving or disapproving the recommendations in whole or in part, and, after giving the necessary orders to carry out the part that he concurs in, he returns the report to the medical officer. Should the medical officer adhere to the opinion that a recommendation which the commanding officer has not accepted should nevertheless be carried out, he is not only at liberty but he is required to make a statement to that effect upon the original paper, which then proceeds through the regular channels to higher authority; ultimately, with the action of the intermediate commanders upon it, to Washington. Sometimes, although rarely, the commanding officer is over-ruled. But it must be very clear that he is wrong, for naturally in the interest of discipline the presumption in his favor must be maintained. Discipline may be impaired if the adverse opinions of subordinates are unwisely sustained. For effective discipline the commanding officer must fill the rôle of a demi-god. When medical officers learn to advise only what is practicable, and when commanding officers learn to consider carefully that advice and to follow it if possible, there is not only harmony but there soon will be general progress.

One of the serious difficulties to be overcome in our great camps, a difficulty the Japanese appear to have practically avoided, is that of subordination, of obeying orders because they are orders. If our people were more accustomed to obedience, if they respected authority as such and did not act as though every person under all circumstances is the exact equal of every one else and therefore need only obey such instructions as he saw fit, we would get along better. The Japanese, while in no respect surrendering their personal courage, have a natural submission to authority, which they respect much more than the average American does. Their English traditions probably render our

Canadian brethren better off than we in this respect. I do not know how it is in Mexico, but I suspect that our friends there also are our superiors in this matter. Perhaps this point may fairly be illustrated by an incident in the Philippines. A command consisting of a regular battery and a somewhat larger number of volunteer infantry went together on a reconnoissance. The orders were that no water should be drank that was not freshly boiled. The regulars obeyed it as a matter of course, because it was an order. The volunteers paid no attention to it, because they thought they knew drinking water when they saw it, so they drank as they were disposed along the way. The upshot was that the regulars came back as well as when they went out, while the volunteers were ravaged with dysentery. There is every reason to believe that their sickness was the pure and simple consequence of this disobedience, for the gentlemen in nominal command of them had not force enough to make them do what they should. When volunteers are raised you call them soldiers, and when a considerable number are consolidated you call them an army. But to put a blue or khaki uniform on a man you take out of a shop or from a field does not make him a soldier. To be a soldier a man must be specially trained and acquire a willingness to do what he is told by his superior, whether he approves of it or not; in fact, without discussing with himself the question of preference. The frame of mind, which is the essential soldierly condition, without which our camps of concentration will suffer for all time (even assuming that our officers, medical and line, are competent) may be illustrated by an incident during the Chicago riots. A regiment of infantry, wearing the rough uniform of the field, had been hurried from the frontier by the President's order to assist in preserving the peace. The strikers looked upon them as of their own class, as indeed they probably were before enlistment, so that they attempted to fraternize with them when they were dismissed to quarters. Selecting a vigorous sergeant, the strike leaders made friends with him, treated him in a saloon, and said "Johnny, you soldiers are not going to fire on us, are you?" "That's just as the Captain says," was the reply. It was a matter of perfect indifference to him; the responsibility was not his, but the obligation to obey the orders was. The Japanese appear to be constantly in that frame of mind: they obey their captains in eating and drinking, as well as in other matters, and the captains follow the advice of the military sanitarians.

The expiration of my time compels the cessation of these remarks.

DR. J. J. KINYOUN, of Glenolden, Penna. — It is presumption for me to attempt to discuss military hygiene, and I so stated to Dr. Wesbrook

when he requested me to give him some points regarding this subject. It is a subject that I know very little about, and the only experience which I have had with regard to military hygiene was gained on Angel Island, in dealing with certain regiments of troops that were in quarantine, as well as those returning from the Philippine Islands. Of course, anybody can criticize, and I suppose that I would criticize about as severely as anyone, but whether that would be just criticism or not, it is a question.

As General Woodhull has pointed out there must be some one in authority. That is absolutely necessary, otherwise there would be no discipline.

With regard to the regular troops, I will say that they returned from the Philippines in far better condition physically and mentally than did the volunteers.

It takes a long while to make a doctor; it takes a long while also to make a soldier, and without discipline and rigorous training of years, it matters not what we may think, we will have a repetition of those conditions which arose during the Spanish-American war. There is one thing, however, that should be remedied, and that is a closer bond of union between the commanding officer and the medical officer. I do not speak with reference to the commissioned officer and the regular troops so much as I do of the volunteer. Many good men taken from civil life and put into military service often fail to grasp the main features that are necessary to preserve the health of troops in camp and field. As I said, it requires an intimate knowledge, gained by experience, this cannot be obtained from books. There is one thing also that seems to me very pertinent — perhaps I should not say it — and that is the conditions which arose on the transports or vessels returning both from Cuba and from the Philippines. It was the exception to find a regular commissioned medical officer aboard these ships; they were only contract surgeons. It appeared to me the conditions suggested the idea that the commanding officers, in the Philippines particularly, were anxious to get rid of the contract surgeons; they detained them on board the transport, the worst places they could have been placed, judging from the condition of the personnel on arriving in the United States.

There seems also a tendency on the part of the commanding officer to judge for himself what is necessary, and what is not necessary, and to ignore oftentimes the suggestion of his medical officer. How that can be remedied, I do not know. Perhaps if we could have a body of reserve medical men and trained particularly in military hygiene, camp sanitation, so that when any great emergency arises, as

has in the past, we can be confident of having a better set of medical men than we had in many instances in the last war.

General Woodhull spoke about the racial difference between the Japanese and the American troops. There is a great difference, indeed, and I do not think the comparison between what has occurred in the Japanese army and in the American army and regular army is exactly fair. There is a peculiar order of mind among the Japanese. How brought about I do not know, but they have great respect for their superiors, and they will obey, try to carry out the details which the ordinary American would oftentimes question. The whole success of the military life of the Japanese army, I think, depends very largely upon this feature. Just what the relations are that exist between the commanding officer and medical officer I do not know, except what has been given me by some of my friends in Japan, and I have inferred from what I have learned that they were consulted far more frequently regarding sanitation and sanitary matters of the army than in our own service.

My experience, as I have previously stated, with the United States forces has been exceedingly limited, and it would not be fair for me to draw any hard and fast conclusions from such.

There is another thing which I believe has promoted the health of the Japanese army considerably, and which would be impossible to adopt here, and that is the protection of large numbers of troops against camp diseases. I was told that two of the Japanese medical officers had taken three army corps, approximating nearly one hundred thousand men each, and separated them into two groups. One half of these they inoculated with antityphoid vaccine; one-half of another group were inoculated with the dysentery vaccine, and another group were inoculated with cholera vaccine. They were sent to the front. They then had in the three corps, an equal number of men to make comparisons. Of course, they would expect some of them to be killed, and the number would not be quite so large on returning, but they would have sufficient data on hand to prove or disprove the efficiency of this treatment, and also how long it lasts. In September last I learned that there was practically no dysentery or typhoid fever in the Japanese army. No cholera cases have occurred during the campaign at Port Arthur or farther north.

It is a difficult matter, unless by long training, to get a soldier to carry out what the medical officer or his commanding officer wishes him to do. I am sure, that a well disciplined troop would, in a measure, carry out instructions not to drink raw water; but a tired, thirsty, hot

volunteer will drink water out of a cow track, irrespective of any command you may give him. (Laughter and applause.)

DR. JUAN BRENA, of Mexico City, Mexico.— The gentlemen who have just spoken have treated the subject from the standpoint of the commanders of the army. In Mexico, during the wars we had there, there was always a medical staff which tried to give its orders to the military commanders, and in such cases these orders from the medical staff were nearly always obeyed, or if they were not obeyed, the medical staff was consulted by the army officers in regard to medical affairs.

When our men are chosen for military service, the medical officer examines them and signs a certificate which states whether they are able or not able for military service. The commanding officers frequently consult the medical officers with regard to the best measures for the health of the army, and as to the physical condition of the men who need to be sent to the hospital. Sanitary measures for the army have been carried out now for about thirty years, and the medical service of the army is quite perfect. We have not very many military hospitals scattered throughout the country. When the medical officers have difficulty with the commander-in-chief in regard to carrying out certain regulations or suggestions which they consider are essential for the health of the troops, the communication of the medical officers is sent to the Secretary of War, and if he thinks the medical officers are right, he suggests to, or perhaps demands of, the commander-in-chief that their suggestions or recommendations, whatever they may be, be carried out.

DR. FREDERICK MONTIZAMBERT, of Ottawa, Ontario.— I did not expect to be called upon to participate in this discussion, for the reason that the subject is one about which I have very little information. My only experience in the volunteer service was as a combatant officer. I regret greatly that our Medical Director-General of the Department of Militia is not here, as I hoped he would have been, to speak on this subject. I know that great attention is being paid to these matters by the Minister of Militia and the head officers of the Department under him. Many additional bearer companies and other parts necessary for the medical equipment of any army have been organized. Some of them accompanied the Canadian troops to South Africa, and were favorably commented upon by the British medical authorities. Some of the appliances they took with them were adopted by the British Medical Service, so that you see we are trying to keep fairly up-to-date in these matters.

If I may, I will refer to a small matter in connection with what has

been said to-day about the Japanese army. Possibly, however, it was referred to while I was out of the room. I heard some remarks with reference to the Japanese army, and it was stated that a good deal of their success could be attributed to the fact of their readiness to obey commands. I saw within the last day or two, as doubtless many of you saw, in one of the newspapers the report of an interview with one of the physicians under Admiral Togo (Surgeon-General Suzuki, of the Imperial Japanese Navy), which goes to show that the circumstances which led to the decrease in sickness and in mortality in the Japanese army, were not entirely dependent upon the greater readiness of the Japanese soldier to obey. Those of you who saw a report of this interview will remember that Surgeon-General Suzuki and other surgeons on the battleships under the command of Admiral Togo that met the Russian fleet insisted upon the men taking a bath and changing their underclothes before they went into action, with the idea, of course, that cleanliness of the skin and of the underclothing would reduce materially the danger of septicemia from portions of the clothing or dirt on the skin being carried into the wounds. That impressed me very much, and it would seem to indicate that it is not only the obedience of the Japanese soldier, but the greater precautions that are taken by the medical officers which contribute to the lessening in sickness and to a low mortality rate.

DR. WILLIAM BAILEY, of Louisville, Kentucky.— Before this subject is passed, I desire the privilege of asking for a talk from a member of the Medical Department of the U. S. Army, a man who has made himself notorious on account of the work that he has done in the last few years. I refer to Dr. Carroll, and I am sure the Association would like to hear him speak on this subject.

DR. JAMES CARROLL, of Washington, D. C. — My experience with armies in the field during the recent war was very limited. Practically all that I saw was during a visit I made to Camp Alger, Chickamauga Park, and Jacksonville, Fla., for the purpose of making blood examinations for malarial parasites, etc. One fact was impressed upon me whilst I was at Chickamauga. The late General Boynton, Superintendent of the Park, in driving me over the grounds pointed out certain locations where whole regiments of regulars had been encamped for years before this time, and they had suffered in no way from typhoid fever. On the contrary, they retained perfect health. On the other hand, when larger numbers of volunteer troops were encamped upon the same ground, in a few months they became stricken and decimated with typhoid fever. We can learn a lesson from that. Koch comes out plainly in his expression of opinion that water is not the only vehicle

of contagion in typhoid fever, and that we must consider also the matter of direct contagion from one person to another. Of course, we know that from a sanitary point of view the hygienic conditions of the camps were not all that could be desired. There is good reason to believe that men may carry typhoid bacilli from stools and urine on their shoes and convey them into their tents. We can have typhoid develop from contact with the secretions from the air passages and with the intestinal discharges, and it is very evident that from such sources men can easily become infected if they are not cleanly in their habits, and men under conditions of lax discipline in camps are careless in regard to eating, and so forth. As General Woodhull has said, perfect discipline is essential to insure the carrying out of orders and to compel men to take precautions to protect themselves. It seems to me, we are so constituted that we love to do things we are forbidden to do. Our soldiers are fond of doing such things, and it is necessary to take strong measures and to be always vigilant and on the lookout to guard against their contaminating or infecting themselves in many ways.

As I have never served as a medical officer with troops on campaign, I do not feel that I am in a position, Mr. President, to further discuss this subject.

GENERAL A. A. WOODHULL, of Princeton, N. J.—I want to say, earnestly and seriously, that the Medical Department of the Army is still to some extent handicapped by inadequate personnel, and there is a bill before Congress which has been very maturely considered. It has been approved in general terms by the general staff; it has been approved by the former Secretary of War, Mr. Root; it has been approved by the present Secretary of War, Mr. Taft; and it has received a strong endorsement from the President of the United States; but the military committee of the House of Representatives does not see its way to comply with all of the provisions it contains. As I have been retired from active service I have no personal interest in this matter, but I have great interest in the Medical Department of the army and in the army itself, and I ask any of you who are acquainted with or can reach the members of the Military Committees, particularly of the House of Representatives, to exert your influence in behalf of this bill. It has once passed the Senate, and doubtless will again. The trouble is with the House. I have not time to go into detail about this matter, but I trust that you will use your influence in its behalf, and I am sure the Medical Department and all those who are well-wishers of the army will be grateful for your assistance.

DR. GARDNER T. SWARTS, of Providence, R. I.—Inasmuch as this is

a very important subject, and we are supposed to take interest in every line of sanitary work, it would seem appropriate to take some action which will go before the public in proper form. I would move, therefore, Mr. President, that a committee be appointed to present at the next session a resolution expressing the feelings of this Association to the effect that the bill now pending before Congress, and which has been referred to by General Woodhull, be approved by the Association.

The American Medical Association is endeavoring to make itself felt, politically and otherwise, and while perhaps we cannot always agree as to certain things or methods, at the same time, we should express ourselves as a strong body of sanitarians. Perhaps by expressing ourselves in the form of a resolution regarding the bill to which General Woodhull has referred, and which we would all like to see passed, we may gain some advantages in the next ten years.

The resolution was seconded by Dr. Liston H. Montgomery, and was referred to the Executive Committee.

The President appointed on this Committee General Alfred A. Woodhull, Dr. H. M. Bracken, and Dr. Gardner T. Swarts.

Dr. James Carroll, of Washington, D. C., then read a paper entitled "The Lessons to be Learned from the Present Outbreak of Yellow Fever in Louisiana." (See paper, page 272.)

Dr. Eduardo Liceaga, of Mexico, read a paper on "Yellow Fever in Mexico." (See paper, page 284.)

Dr. Juan Guiteras, of Havana, Cuba, followed with "Remarks on Some New Points in the Etiology and Prevention of Yellow Fever." (See paper, page 278.)

At the conclusion of the reading of the papers on yellow fever, the Committee, appointed to draft resolutions in connection with yellow fever in the South, presented the following report, which was referred to the Executive Committee:

WHEREAS, The results obtained during the present epidemic of yellow fever in New Orleans, by the methods of mosquito extermination and by the prevention of the access of the mosquito to the patients, have been far in advance of the results obtained by the older methods;

WHEREAS, It has been possible by the new methods to hold in check and to gradually reduce an epidemic that has taken a firm foothold in the midst of the largest non-immune population that was ever exposed to yellow fever; therefore, be it

Resolved, (1) That the Association sees in these results a further confirmation of the view that yellow fever is naturally transmitted only by the bite of an infected mosquito.

(2) That the Association is of opinion that an efficient plan of

defense against the propagation of yellow fever, at the beginning of an epidemic, can be easily established upon the basis of this doctrine.

(3) That the successful carrying out of such plans depends upon a thorough understanding of the mosquito doctrine by the people, and the support that they may give to the prompt and frank reporting and to the proper handling of the first cases and of all suspicious cases.

(4) The Association wishes further to congratulate the Public Health and Marine Hospital Service for the brilliant work done by Dr. Joseph H. White and his colleagues in New Orleans, and to urge upon all concerned that the said service be called upon to take charge permanently of maritime quarantine along the Gulf Coast.

Regarding the visit of the President to New Orleans, the Association would urge that the contemplated trip be postponed.

Whilst it is true that the epidemic will be very much under control by the 24th of October, so that there will be but little danger of infection, this danger would certainly be enhanced by the public life and inability to surround themselves with proper safeguards that would prevail in the case of the President. If the President were called to New Orleans by some public duty connected with the epidemic—if he were, for instance, to reside in the yellow fever hospital and have some special duty to perform in visiting the sick—it would be very easy to guarantee his safety from infection; but with a number of public functions to perform, entertainments to receive, and numerous places to visit, the Association does not believe that an absolute security can be promised at a time when there may still be in existence a number of active, infected mosquitoes.

The Association is also of opinion that the large influx of strangers that would attend the visit of the President would result in a temporary increase of the number of cases.

(Signed) JOHN GUITERAS, *Chairman*,
PRESTON H. BAILHACHE,
JAMES CARROLL,
E. LICEAGA,
WM. BAILEY.

DISCUSSION OF THE PAPERS ON YELLOW FEVER.

DR. LISTON H. MONTGOMERY, of Chicago.—Dr. Guiteras in his remarks spoke of the authorities in New Orleans trying to exterminate every mosquito, but he thought, if I understood him correctly, that this detracted considerably from their work, and that they should concentrate their action or attack upon the infected mosquito. How can that be determined? Would it not be better to exterminate all mosquitoes, whether they are the harmless or infected ones?

DR. JOHN GUITERAS, of Havana, Cuba.—I expressed the idea that considerable energy was being diverted from the proper and best channels. In answer to the question of Dr. Montgomery, I will say that it

is easy to determine which are infected mosquitoes from those that are not. Infected mosquitoes are those found in the houses of patients, and we should kill them. The yellow fever mosquito is a weak mosquito; it is apt to stay in the same room, and certainly in the same house.

DR. JAMES CARROLL, of Washington, D. C. — Dr. Guiteras has taken it for granted, without full justification, it seems to me, that my idea was that this commission I have suggested should go down and stamp out such an epidemic as prevails in New Orleans at present. I intended nothing of the kind. I spoke of preventive rather than curative measures, and the idea I had in my mind was that if a commission, appointed at the proper time, could take up the work in a proper way and prevent or control the extension of the disease, at the season when the cases were fewest, it would accomplish a great deal. This measure was suggested by me upon the ground that if such a commission were in existence, and the proper laws were enacted, it would require physicians to report their cases of yellow fever early, so that the disease could be readily controlled, and then there would be no possibility of its further extension.

In regard to educating the people, did we wait for their education before laws were enacted requiring proper disinfection to prevent the extension of diphtheria? It has taken five years, and that has not been sufficiently long to educate the physicians in some of our states up to the point of believing in the mosquito theory fully, and it seems to me it would be much less important to wait for the education of the people when it takes some physicians more than five years to accept the mosquito theory. Reasoning on this basis, how many more years will it require to educate the people up to that point? This is a matter of protection of the lives and welfare of the people, and their personal ideas and idiosyncrasies are not to be considered. We know absolutely that if these measures are taken in proper time, any extension of the disease can be prevented, and the only thing to do, in my opinion, is to take such measures and thereby see to it, when the disease is found to exist, or when the cases are at a low ebb, that proper measures are taken, and that the possibility of any further extension of the disease be removed. In this way the disease can be eventually stamped out, and once it is stamped out, it is done with forever unless there is a fresh importation.

On motion, the Association adjourned until 10 A. M., Friday.

SEPTEMBER 29 — FOURTH DAY.

MORNING SESSION.

The Association met at 10:10 A. M., and was called to order by the President.

THE PRESIDENT.— We will listen to the Report of the Executive Committee by the Secretary.

THE SECRETARY.— The Executive Committee has acted favorably upon the resolutions in regard to yellow fever in New Orleans, except as regards advising the President not to visit that city, and recommends their adoption by the Association. A sub-committee will report upon this part of the resolutions. (See resolutions on page 444.)

THE PRESIDENT.— You have heard the recommendations of the Executive Committee concerning these resolutions on yellow fever. What is your pleasure?

DR. WILLIAM BAILEY, of Louisville, Kentucky.— I move that the resolutions be adopted. Seconded and carried.

The Secretary read a resolution offered by Dr. J. Ewing Mears (see resolution, page 424), and said: The Executive Committee finds that a similar resolution was recently adopted by the Association, and therefore it deems it unnecessary to take further action at this time.

THE PRESIDENT.— Will you confirm the action of the Executive Committee, or do you wish to adopt this resolution?

DR. HENRY D. HOLTON.— I move that the action of the Executive Committee be concurred in.

Seconded by Professor Brewer, and carried.

THE SECRETARY.— The following resolution are offered as representing the sense of the American Public Health Association:

RESOLVED, That this Association, recognizing the extreme value of a properly organized and efficiently administered medical department as an essential part of any army, cordially approves the proposal for the greater efficiency of that department in the army of the United States, as embodied in a bill brought before the fifty-eighth Congress (Senate, 4838; H. R., 13908, fifty-eighth Congress, second session), and earnestly recommends favorable action upon such a measure when it may again be brought up for consideration;

Resolved, That an official copy of these resolutions be transmitted to the committees on military affairs of the Senate and of the House of Representatives of the United States, and to the surgeon-general, United States army.

(Signed) ALFRED A. WOODHULL,
H. M. BRACKEN,
GARDNER T. SWARTS,
Committee.

THE SECRETARY.—The Executive Committee has recommended the adoption of this resolution, as read.

THE PRESIDENT.—What disposition will you make of this resolution?

DR. BAILEY.—I move that it be adopted.

Seconded and carried.

THE SECRETARY.—The following preamble and resolutions were acted upon favorably by the Executive Committee, and are recommended to the Association for adoption:

WHEREAS, The American Public Health Association has lost by death, among others, three of its most valued members, Brigadier-General Charles Smart, U. S. A., retired, one of the earliest members; Dr. Thomas Messenger Drown, President of Lehigh University, and consulting chemist for the Massachusetts State Board of Health, and Mrs. Grace Van Everen Stoughton, bacteriologist in the Research Laboratory of the New York Health Department, one of the more recent members; therefore, be it

Resolved, That we, the members of this Association, in convention assembled, do hereby express our sense of the great public and personal loss which has been sustained. They were all, during the longer or shorter periods of their membership, deeply interested in the work of this Association, and each of them was particularly and efficiently occupied with some phase of the question of the purity of water supply. Their public services were eminently valuable, and their personal qualities endeared them to all with whom they came in contact.

Resolved, That as an expression of the feelings of this Association the Secretary be instructed to transmit a copy of these resolutions to the families of the deceased, and that the same be entered in the minutes of this meeting.

(Signed) H. P. WALCOTT,
E. H. RICHARDS,
JAMES CARROLL,
R. S. WESTON.

On motion of Dr. Liston H. Montgomery, the resolutions were adopted by a rising vote.

THE SECRETARY.—The following resolution is brought before you by the Executive Committee, with the recommendation that it be adopted. The resolution deals with the action of mosquitoes in the spread of disease, and was sent to the Association by the members of the American Mosquito Extermination Society:

In view of the proved connection of mosquitoes with the spread of disease—

RESOLVED, That the American Public Health Association approves of the work of the American Mosquito Extermination Society, and recommends that it be extended as widely as possible.

On motion of Dr. Samuel H. Durgin, the recommendation of the Executive Committee was concurred in, and the resolution adopted.

THE SECRETARY.—One or two other matters came before the Executive Committee this morning, and were referred to sub-committees, so that the Executive Committee asks permission to make a further report, a little later on in the session.

THE PRESIDENT.—The next matter for consideration is the Report of the Advisory Council.

REPORT OF THE ADVISORY COUNCIL.

The report was read by the Secretary, as follows :

Your Advisory Council begs leave to present the following report : For President, Professor F. C. Robinson, of Brunswick, Maine ; First Vice President, Dr. J. J. Kinyoun, of Glenolden, Pa. ; Second Vice President, Dr. Domingo Orvananos, of Mexico ; Third Vice President, Dr. Richard H. Lewis, of Raleigh, N. C. ; Treasurer, Dr. Frank W. Wright, of New Haven, Conn. ; Secretary, Dr. Charles O. Probst, Columbus, Ohio ; Members of the Executive Committee, Dr. John Guiteras, Professor H. L. Russell, and Dr. W. C. Woodward.

Mexico City was chosen as the next place of meeting.

THE PRESIDENT.—The report of the Advisory Council is before you. What action will you take on it ?

DR. SAMUEL H. DURGIN.—I move that the report of the Advisory Council be approved by the Association and adopted, and that the Secretary be instructed to cast the unanimous ballot for all the officers named.

Seconded by Dr. Wm. Bailey, and carried.

The Secretary then cast the unanimous ballot of the Association, as instructed, and the officers were declared duly elected.

Dr. Henry D. Holton moved that the report of the Advisory Council be accepted as a whole, and that the invitation of the members from Mexico to hold the next meeting in that city be accepted.

This motion was duly seconded and carried.

THE PRESIDENT.—I think it is proper that the President-elect should be introduced at this time, and I will ask Dr. Durgin to escort Professor Robinson to the platform.

The Association is to be congratulated on having elected Professor Robinson as its President, and I can wish for him no greater happiness than I have had during the past year. (Applause.) It is my pleasure to present to you your new President, Prof. Robinson, of Maine.

PROFESSOR ROBINSON.—I feel very grateful for the distinguished honor you have conferred upon me. I feel that you have taken a great responsibility, and that you have made a move that the Association has never made before. I wonder if you realize that you have elected as President of the Association a man who is not a physician; that you have elected as your President of an Association consisting largely of health officers a man who has never had experience in that work practically. In short, you have selected an amateur to lead experts, a volunteer to lead trained battalions, and you must expect that kind of leadership. I only hope that when you go home you will be able to give a proper account of this to your constituents, but I am afraid you will have trouble in doing it. I hope you will not be reduced to such an explanation as Aaron gave on the occasion, when, you will remember, he was called to account by Moses for having made and sent that image to lead the children of Israel. All he could say was, in substance, Behold, we cast much gold into the fire, and there came out this calf. (Laughter and applause.)

I am not a doctor of medicine; nothing but a doctor of laws, and you know that a doctor of laws does not necessarily know much about doctoring. But I think if we all pull together, we shall have a successful meeting, and I will try and head you as well as I can — be a figure-head, at least, like the calf, and only hope I shall not be ground to powder afterwards as it was. It happens, fortunately, that there will be many things next year to take your attention from the President. We are going to the land of sunshine and flowers, of earnest men and fair women, a country that has recently come forward to take its place among the nations, not by reason of a war, but by the civil action of that wonderful man at the head of it — President Diaz, who has spread his wand of power over that land like the magician of old, and seen order come out of chaos, strength out of weakness. You won't need any President down there. You won't care what he does. If we can arrange perhaps to do most of the work on the train going there, as has been suggested, we shall have all the better opportunity to enjoy that beautiful country.

Finally, I have nothing revolutionary to offer. I appreciate that this is a great Association, the leading one of its kind in the world, and that it is a great responsibility to head it. It is a representative association. We must not forget that. We come together from year to year; we represent the sanitary spirit of four countries, and if we are ever-progressive we shall be successful. It is not that this Association needs particularly an influx of new life; there is plenty of life in it. All that I should hope to do would be to keep that life in circu-

lation and possibly guide it into some little channels where it has never gone before. I thank you very much. (Applause.)

DR. HENRY D. HOLTON. — Your sub-committee, to whom was referred by the Executive Committee the matter of communicating with President Roosevelt, desires to recommend that the matter be dropped from further consideration, and that the President of this Association be authorized to communicate to President Roosevelt what he shall deem expedient in the matter.

On motion, the recommendation of the sub-committee of the Executive Committee was concurred in, and the President-elect was so authorized.

DR. HENRY D. HOLTON presented the following resolutions of thanks :

To the Committee of Arrangements:

The members of this Association and their friends, attending the meetings during this week, assure you of our high appreciation of the many courtesies you have shown us. The recollection of these kind attentions will linger with us as a pleasant memory during the months and years to come. We would extend to the Ladies' Committee our most gracious compliments for their thoughtful care and various entertainments for the ladies who have been in attendance, proving themselves the true almoners of joy and happiness. We would especially acknowledge our obligations for many courtesies from the Merchants' Committee; their thoughtful consideration of everything calculated to make our stay in this city most pleasant and agreeable could not have been surpassed; at the same time, we recognize the many favors received from the Massachusetts Institute of Technology, for which we express our thanks.

To the officials of the New York, New Haven and Hartford Railway we present our thanks for their kindness in exhibiting the sanitary arrangements at their stations in this city and the methods used in cleaning their cars. You are certainly to be congratulated upon the adoption of sanitary methods in these departments.

We appreciate the courtesies extended to us by various railroads in the matter of transportation, as well as to the L. C. Smith & Bros.' Typewriter Co. for placing at our disposal one of their typewriters, with a stenographer.

THE PRESIDENT. — What will you do with these resolutions of thanks?

DR. GARDNER T. SWARTS. — I move to amend that a copy of the resolutions be sent by the Secretary of the Association to the various persons mentioned, in order that the resolutions may have their effect.

The amendment was seconded, accepted, and the resolutions as amended were unanimously carried.

The Secretary presented the following resolutions from the Executive Committee:

Resolved, That a committee of six, to be composed of the incoming President, the Secretary, the Chairman of the Laboratory Section, and three members of the Association to be selected by the President, shall be appointed to consider the suggestions contained in the address of the President and to recommend such changes in the methods at present employed in conducting the work of the Association as in the judgment of the committee will promote the usefulness of the organization;

Resolved, That the report of said committee shall be printed and distributed to the members of the Association on or before September 1, 1906;

Resolved, That said committee shall constitute the Committee on Program for the coming year.

It was moved by Dr. Henry Mitchell, and duly seconded, that these resolutions be approved by the Association. Carried.

Dr. Theobald Smith, of Boston, read a paper on "The Relation of Animal Life to Human Diseases." (See paper, page 328.)

Mr. Alexander M. Wilson, of Boston, Mass., read a paper entitled "The Boston Day Camp of Tuberculosis." (See paper, page 300.)

DISCUSSION.

DR. EDWARD O. OTIS, of Boston. — I have only a few words to add to what Mr. Wilson has said with regard to this camp. As to the permanent results that may have been obtained, it is at present impossible to make any statement. The physician in charge will report later upon this, but it is certain that the patients have improved from the fact that they have gained in weight, and in many cases lost their fever.

I would like to emphasize the educative value of such camps which, perhaps, after all, is the most valuable part of the experiment. These poor patients are taken out of the tenement house portions of the city, and are given an illustration of what fresh air will do and what good food and cleanliness will accomplish. They go back home again and teach others about the value of these things. Secondly, the extreme simplicity and cheapness of the experiment. In portions of the country, where access cannot be had to State sanatoria, it is perfectly feasible for a few thousand dollars to establish a camp of this sort. While it does not do as much as a sanatorium does in all its completeness, yet it does the work on similar lines, as far as it goes, and it is an encouragement to know that a camp of this kind can be equipped and started

so inexpensively, and is within the means of almost any community of any considerable size. Furthermore, I believe where communities are making exertions to interest their people in the matter of fighting against tuberculosis and inducing them to make contributions and to do work for this cause, in securing appropriations from their State, etc., such an object-lesson as this is of great value in showing the people what can be done. In Boston we readily obtained the money for this experiment, starting, as we did, with hardly a cent advanced for it. I can heartily recommend this experiment as an entering wedge towards further and more extended effort in the struggle against tuberculosis.

DR. PETER H. BRYCE, of Ottawa, Ontario. — I would like to ask why it is that it is proposed to stop this tuberculosis camp in the future, or rather, to run it for the summer only?

DR. OTIS. — We started this camp on faith so to speak, depending upon the experiment itself as an object-lesson to bring in the amount necessary to carry it on, and only asked for sufficient means for the summer months. Moreover, the portion of land where the camp is situated was loaned to us by another institution for the summer only. Therefore, we have no claim on it further than its use for the summer months. We do hope, however, and trust in the future we may obtain permanent use of a portion of the land and sufficient means to carry on this experiment throughout the year. That is our intention.

A paper by Dr. John S. Billings, Jr., of New York, entitled "Relation of the Milk Supply of New York City to Typhoid Fever," was read by title. (See paper, page 304.)

Mr. Charles E. Marshall, of the Agricultural College, Michigan, contributed a paper entitled "The Associative Action of Bacteria in the Souring of Milk." (See paper, page 312.)

A paper by Dr. D. E. Salmon, of Washington, D. C., entitled "The Federal Meat Inspection Service," was read by title. (See paper, page 339.)

Dr. José D. Morales, of Mexico, read a paper entitled "The Preservation of Food with Antiseptics." (See paper, page 369.)

Dr. José de la Luz Gomez, of Mexico, contributed a paper on "A Disease of Cattle in Mexico." (See paper, page 342.)

Dr. Gardner T. Swarts moved, owing to the lateness of the hour, that the authors of papers who are present be asked to present abstracts of them or their conclusions. Seconded and carried.

Dr. Adolfo Oliva, of Mexico, read a paper on "The Selection of Physical Exercises Suitable for School Children." (See paper, p. 169.)

Mr. Burt Ransome Rickards, of Boston, read a paper entitled "A Consideration of Some of the Problems and Difficulties of Bacteriological Diagnosis." (See paper, page 349.)

As there was no further business to come before the meeting, the Association, on motion of Dr. Gardner T. Swarts, then adjourned, to meet in the City of Mexico in 1906.

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REPORT OF COMMITTEE ON NECROLOGY.

CHARLES SMART, M. D.

Brigadier General Charles Smart, U. S., retired, who died at St. Augustine, Florida, April 23, 1905, was a valuable member of the Association continuously since 1882. General Smart was a native of Scotland, and was born September 18, 1841. He was graduated in 1862 from the University of Aberdeen with the degree of M. D. and C. M. With the expectation of entering the Medical Corps of the British Army he came almost immediately to this country, where the Civil War was then raging, in order to acquire practical experience in the field before going up for his examination at home. He had previously, that is between the third and fourth years of his medical studies, widened his observation by a nine months' cruise in the Arctic regions, in charge of the health of a whaling crew. Reaching the United States in the autumn of 1862, he was appointed as Assistant Surgeon in the 63d New York Volunteer Infantry, November 5, of that year, and he was on regimental duty with that command in the Army of the Potomac until April 15, 1864, when he was mustered out in order to accept a First Lieutenancy in the Medical Department of the Regular Army, acquired after the usual competitive examination, to date from March 30, 1864. He became the Acting Medical Inspector of the Second Corps, Army of the Potomac, almost immediately, and was on that duty from May, 1864, until July, 1865, when the war having ceased, he accompanied a battalion of the Second Artillery to the Pacific coast and was on duty near San Francisco until the following December. He had been brevetted Captain in the Army December 2, 1864, for meritorious services in the field, and he became Captain in the Medical Department by regular promotion July 28, 1866. He accompanied a battalion of the Fourteenth Infantry to the Department of Arizona in January, 1866, and was on duty at various posts there and in the field, the latter part of the time as Chief Medical Officer of a District, until July, 1869, when he accompanied the same troops to Kentucky. He served in various garrisons from Washington to Raleigh until the summer of 1873, when he reported at Fort Bridger, Wyoming, and was on duty in the Department of the Platte at several successive stations, a part of the time in the field with Colonel Merritt's Expedition, until December, 1877. After eighteen months' service at

Fort Preble, Maine, he was assigned to duty with the National Board of Health, September 19, 1879. This duty terminated in February, 1883. In the meantime he had been promoted Major in the Medical Department June 30, 1882, and in addition to his association with the Board of Health he was placed on duty in the Surgeon General's office June 29, 1883. He remained a part of the administrative staff of the Surgeon General of the Army more than nineteen years, or until October 25, 1902. He had been promoted Lieutenant Colonel in the Medical Department May 3, 1897, and Colonel February 2, 1901. He was the Chief Surgeon, that is, the administrative medical officer, in the Philippines from November 30, 1902, to August 15, 1904, when his health having become seriously impaired he was recalled. He was retired January 19, 1905, advanced to the grade of Brigadier General on the Retired List the same day, and died as already noted, April 23, 1905.

General Smart's career presents that of a medical officer who rendered valuable service in the field during war, both in connection with a large army and in Indian hostilities, and also possessed unusual scientific qualities which he maintained in high efficiency. He was a chemist of excellent ability, especially in the matter of water analysis; he was a clear and logical writer; and he possessed a genius for hard work which was frequently and for long periods demonstrated by the variety and amount that he turned out in his administrative service. While on duty in Washington he prepared the Third Surgical Volume of the monumental Medical and Surgical History of the War of the Rebellion; he was the Disbursing Officer of the Medical Department of the Army, and as such supervised large and complicated accounts; and he was in charge of the Sanitary Division of the Surgeon General's Office. This last alone required him to revise the sanitary history and to be familiar with the reported conditions of all the military posts, and to consolidate and present those data for the use of the Surgeon General. He was frequently occupied with chemical work in the interest of the military service, and he belonged to the Faculty of the Army Medical School from its organization in 1893 until he went to Manila. He was repeatedly on duty as a member of boards for the examination of candidates for the Medical Corps, he was also upon boards that prepared a system of drill for the Hospital Corps, a Manual for the Medical Department, and for the determination of the Emergency Ration. He compiled the Handbook for the Hospital Corps, which is the official text-book. General Smart represented the Medical Department of the Army at the meetings of this Association in 1892, 1894, 1896 and 1897, and his contributions to its proceedings are of permanent value. His

official life was completely, conscientiously, and efficiently devoted to the service of his adopted country, for he soon abandoned his purpose of returning to Great Britain. He had few distractions and none that interfered with his public work, although with advancing years their infirmities somewhat limited his activities. He was very patient, steadily industrious, naturally measuring up without effort to the full standard of official and social courtesy and obligations, and withal he was intellectually a brilliant as well as a painstaking man, fond of his friends and true to his public ideal. In his earlier life he produced a little fiction which contains admirable descriptions of active military life, both during the great war and under the conditions of the Arizona frontier in the late sixties.

General Smart is survived by two sons, who are medical officers of the army, and by two daughters.

THOMAS MESSENGER DROWN, M. D.

Thomas Messenger Drown, President of Lehigh University, a valuable member of this Association since 1887, died November 16, 1904, after a critical operation.

Born in Philadelphia, March 19, 1842, he attended the public schools of the city, fitted up a chemical laboratory on his father's grounds while a boy, graduated in 1862 as Doctor of Medicine from the University of Pennsylvania, and served as surgeon on a packet steamer. Then, abandoning medicine, he spent eight years in the study of chemistry in America and in Europe, and opened an office in Philadelphia as analytical and consulting chemist. Here he spent four years gaining a knowledge of men and of things which stood him in good stead later.

For the next twenty years the teacher's calling at Lafayette College and at the Massachusetts Institute of Technology was his chief interest, and the effect of his high character and scientific acumen on his many pupils cannot be measured. It was at this time that he became interested in accurate and rapid methods of analysis for industrial enterprises. As Professor H. M. Howe says, "Few Americans have ever interpreted and applied scientific facts so directly for the welfare of the public as the late Dr. Drown."

For ten years of this time, he held the office of Secretary of the American Institute of Mining Engineers, the parent society of most of the mining societies with the exception of the Civil Engineers. It numbered only 22 members when he took it. He left it 1,300, with a perfected organization which lamented the loss of a perfect secretary.

The literary training that these ten years gave, in addition to the

knowledge of the whole of the country, and the acquaintance with metalurgical and mechanical problems gave an added preparation for his two final positions: chemist for the Massachusetts State Board of Health during its classical investigations, and president, for ten years, of Lehigh University.

He died in harness, having held a faculty meeting just before going to the hospital to submit to the surgeon's knife.

His interest, always keen in the newest phases of science, became focussed on the practical problems of water supply when he was called upon to organize the laboratory investigations of the Massachusetts State Board of Health, under the authority of the legislative act "to protect the purity of inland waters," 1886.

To this work he brought ripe experience in many lines of analytical method and in the clear and systematic recording of results, with a literary style too often lacking.

His medical education at the University of Pennsylvania and his knowledge of men and affairs enabled him to co-ordinate and interpret the work of chemists, biologists, and engineers to a remarkable degree, so that at last there was organized a staff of hitherto heterogeneous elements all working harmoniously to one great end.

In the memorial adopted by the State Board of Health are found these words:

"He appreciated the importance to the community of the work which this board was endeavoring to perform, and entered into his part of it with an earnestness and devotion that supported and encouraged every one associated with him.

"His great knowledge, his appreciation of its limitations, his clear thinking, his justness, his kindness, his sweetness, rendered work with him a delight, and have contributed ennobling characteristics to the work of the board."

GRACE A. VAN EVEREN STOUGHTON.

Grace A. Van Everen Stoughton, a favorite pupil of Dr. Drown and one of the recent members of this Association, 1902, died in January, 1905, after a critical operation.

A graduate of the Massachusetts Institute of Technology (1896) and a teacher of experience, she was strongly attracted toward research work along the lines of sanitation and took a correspondence course with Miss Talbot, of the University of Chicago.

In February, 1893, she passed the civil service examination for the position of bacteriologist in the Research Laboratory of the New York Department of Health. This position she held at the time of her death.

Owing to her broad general training and — because she was not a physician — to her natural interest in other than medical questions, she chose the bacteriology of drinking water for her subject. For the year before her death, she devoted her whole time to research work on intestinal bacteria in their relation to water supply. Up to the very last days of her life she continued at her task so as to leave in permanent form some slight record of her work.

During the last month she prepared a paper on the pollution of the water supplies of New York City entitled "Concerning the Characteristics of Colon Bacilli and the Value of the Presumption Test," read at the Havana meeting of the Laboratory Section of this Association.

She was greatly esteemed in the laboratory for the high grade of the work that she was doing and for her fine and lovable character.

The world and this Association are the poorer for the loss of a worker of great promise, for to her energy and enthusiasm were added a clear brain and great tenacity of purpose.

H. P. WALCOTT,
E. H. RICHARDS,
JAMES CARROLL,
R. S. WESTON,

Committee.

CONSTITUTION
OF THE
AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This Association shall be called "THE AMERICAN PUBLIC HEALTH ASSOCIATION."

OBJECTS.

II. The objects of the Association shall be the advancement of sanitary science, and the promotion of organizations and the measures for the practical application of public hygiene.

MEMBERS.

III. The members of the Association shall be known as Active, Associate, and Foreign.

The Executive Committee shall determine for which class a candidate shall be proposed. The Active members shall constitute the permanent body of the Association, subject to the provision of the Constitution as to continuance in membership. They shall be selected with special reference to their acknowledged interest in, or devotion to, sanitary studies and allied science, and to the practical application of the same. The Associate members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the Association, but shall not be entitled to vote or hold office. Health officials, and other persons especially interested in matters relating to the public health of countries not included in the Association, may be elected as Foreign members. They shall have all the privileges and publications of the Association, but shall not be entitled to vote or hold office.

Delegates from national, state, provincial, and municipal boards of health, organized sanitary associations, and the army, navy, and public health and marine hospital service, shall be entitled to be enrolled as Active members upon presentation of their credentials to the Executive Committee. Members, not delegates from such bodies, shall be elected as follows:

Each candidate for admission shall first be proposed to the Executive Committee in writing (which may be done at any time), with a statement of the business or profession and special qualifications of the person so proposed. On recommendation of a majority of the committee, and on receiving a vote of two-thirds of the members present at the regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership in each class shall be \$5.00.

OFFICERS.

IV. The officers shall be a President, a First and Second Vice-President, a Secretary, and a Treasurer, and the officers of the various sections.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or in his absence one of the Vice-Presidents, or in their absence a chairman pro tempore, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all committees authorized by the Association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the correspondence and records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association; and shall give notice to the several officers, and to the Executive and other committees, of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments, and at each annual meeting render the same to the Associa-

tion, when a committee shall be appointed to audit his accounts. If, from the annual report of the Treasurer, there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

STANDING COMMITTEES.

VIII. There shall be the following standing committees: (1) The Executive Committee, (2) the Advisory Council, (3) the Committee on Publication.

EXECUTIVE COMMITTEE.

IX. The Executive Committee shall consist (1) of the President, First Vice-President, Second Vice-President, Secretary, Treasurer, and Chairmen of the various sections; (2) of six active members of whom three shall be selected annually by ballot to serve two years, and who shall be ineligible to reelection for a second successive term; (3) of the ex-presidents of the Association; and (4) of the Chairman and Secretary of the Laboratory Section and the retiring chairman of that section.

It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association, to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses; to consider all applications for membership, and at the regular meetings, report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the Association and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association; and such notice shall contain the order of business to be followed at said meeting, and briefly, the subjects to be presented and the special points of discussion.

ADVISORY COUNCIL.

X. The Advisory Council shall consist of one member from each state, territory, and district, the army, navy, and marine hospital service, the Dominion of Canada, and each of the provinces, who shall be appointed by the President on the last day of each session, and

who, besides acting as nominating committee of officers for the ensuing year, to be announced at such time as the Executive Committee may appoint, shall consider such questions and make such recommendations to the Association as shall best secure the objects of the Association. They shall at their first meeting elect from their own number a secretary, whose record of their proceedings shall be made part of the records of the Association.

COMMITTEE ON PUBLICATION.

XI. The Committee on Publication shall consist of a Chairman, the Secretary of the Association, the Treasurer of the Association, and a member of each section of the Association, with the President of the Association, *ex-officio*; who shall contract for, arrange and publish, under authority of the Executive Committee, the proceedings of the Association, including such papers as have been examined and approved by the Executive Committee, or which have been submitted to them by the latter for their discretionary action.

REPORTS AND PAPERS.

XII. All committees preparing reports to be presented to the Association must submit the same to the Publication Committee not later than 30 days before the succeeding annual meeting of the Association; and all papers other than committee reports shall be in the hands of the Secretary not less than 20 days before.

MEETINGS.

XIII. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called at any time or place, by concurrence of two-thirds of the Executive Committee. There shall be no election of officers, or change of by-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular to all the members, together with the order of business.

QUORUM.

XIV. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the constitution, the election of members, and the appropriation of moneys.

CONSTITUTION.

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ORDER OF BUSINESS.

XV. The order of business at all meetings of the Association shall be fixed by the Executive Committee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four-fifths present.

ALTERATION OF CONSTITUTION.

XVI. No alteration in the constitution of the Association, shall be made except at an annual meeting, or unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two-thirds of the members present.

SECTIONS.

XVII. Members of the Association may be authorized to form themselves into sections by vote of the Association at any annual meeting; such sections shall have power to nominate their officers to be elected by the Association, and to make by-laws which shall go into effect when approved by the Association.

BY-LAWS OF THE EXECUTIVE COMMITTEE.

QUORUM.

1. Five members shall constitute a quorum for the transaction of such business as may come before the committee.

MEMBERS RESTRICTED.

2. No elective member of the Executive Committee shall be at the same time a member of the Advisory Council, if there is another member of the Association from his state or service.

PARLIAMENTARY USAGE.

3. Cushing's Law and Practice of Legislative Assemblies shall be the guide in parliamentary practice until otherwise ordered.

PAPERS.

4. Papers to be presented at a general session of the Association shall be in the hands of the Secretary of the Association not less than twenty days before the coming meeting, and to be printed in the transactions in full or in abstract at the discretion of the Publication Committee.

5. All papers accepted by the Association, whether read in full, by abstract, by title, or filed, shall be delivered to the Secretary as soon as thus disposed of, as the exclusive property of the Association. Any paper presented to this Association and accepted by it shall be refused publication in the transactions of the Association, if it be published in whole or in part, by permission or assent of its author, in any manner prior to the publication of the volume of transactions, unless written consent is obtained from the Publication Committee.

6. Day papers shall be limited to twenty minutes, and evening papers to thirty minutes each.

DISCUSSION OF PAPERS.

7. After the leading papers on each subject, as indicated by the Executive Committee, have been read, discussion shall follow, and be confined strictly to the subject of these papers; and each speaker

shall be limited to ten minutes, and shall not speak a second time until after every other member who desires to be heard, and then only for five minutes, except by unanimous consent.

8. The Chair shall notify gentlemen who desire to speak to send their names, and they shall be called on in the order sent up; and he may, at his discretion, limit the time of speaking to five instead of ten minutes, if in his judgment it may become necessary to do so in order to allow each one on the list an opportunity to be heard.

PUBLICATION COMMITTEE.

9. The Publication Committee shall consist of a Chairman, the Secretary of the Association, the Treasurer of the Association, and a member of each section of the Association, with the President of the Association *ex-officio*.

10. Unless otherwise ordered by the Association, such committee is hereby instructed to keep the size of the annual transactions within the limits of four hundred pages; and to this end to conform to the several following rules:

a. Make summaries of such local and other addresses as are not of permanent scientific value.

b. The Chairmen of the several standing Committees shall be notified by the Secretary that the reports to be presented by them shall include any material prepared by the several members of their committees and must be in the hands of the Publication Committee not later than thirty days before the succeeding annual meeting for preliminary printing.

c. Such reports shall be printed for distribution to the members on registering at the coming meeting; but no report shall be printed unless in the hands of the Publication Committee, as specified above.

11. The Publication Committee shall procure a copyright on the transactions in the name of the Association, and the committee shall have full charge of the publication of the transactions.

APPLICATION FOR MEMBERSHIP.

12. All applications for membership must be made upon the application blank of the Association.

13. Persons not members, having prepared papers to be presented at the meetings of the Association, shall be proposed for membership at the first business meeting of the Association.

EXPENDITURES.

14. All bills connected with the publication of the transactions shall upon the approval of the chairman of the Publication Committee and the Secretary, be signed by the president of the Association, and paid by check of the Treasurer directly to the party concerned; and the President shall not approve any bill, relating either to publishing or printing, without the approval first of the chairman of the committee in charge thereof.

15. Bills for current expenses shall be first approved by the Secretary, then sent to the President, and on his approval they shall be paid by check of the Treasurer directly to the parties interested.

16. The actual and necessary traveling expenses of the Secretary and Treasurer to the annual meeting of the Association, and to one meeting of the Executive Committee, shall be classed as current expenses.

RESOLUTIONS.

17. All resolutions presented to the Association shall be sent to the Chair in writing, and referred to a committee without discussion.

ARREARAGES.

18. The arrearages of all members remitting their dues for two years shall be cancelled up to the date of the last payment, but they shall be entitled to the transactions of the Association only for the years for which they have actually paid.

AUDITING COMMITTEE.

19. An Auditing Committee shall be appointed by the Chair to audit the accounts of the Treasurer, and report upon the same.

OFFICERS AND COMMITTEES OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

OFFICERS 1906.

President	PROF. FRANKLIN C. ROBINSON, Brunswick, Maine.
First Vice President...	DR. JOHN J. KINYOUN, Glenolden, Pennsylvania.
Second Vice President..	DR. DOMINGO ORVANANOS, Mexico City, Mexico.
Third Vice President...	DR. RICHARD H. LEWIS, Raleigh, North Carolina.
Secretary	DR. CHARLES O. PROBST, Columbus, Ohio.
Treasurer	DR. FRANK W. WRIGHT, New Haven, Connecticut.

PRESIDENTS OF THE ASSOCIATION.

STEPHEN SMITH, M. D.....	1872, '73, '74
*JOSEPH M. TONER, M. D.....	1875
*EDWIN M. SNOW, M. D.....	1876
*JOHN H. RAUCH, M. D.....	1877
*ELISHA HARRIS, M. D.....	1878
*JAMES L. CABELL, M. D.....	1879
JOHN S. BILLINGS, M. D.....	1880
*CHARLES B. WHITE, M. D.....	1881
*ROBERT C. KEDZIE, M. D.....	1882
*EZRA M. HUNT, M. D.....	1883
*ALBERT L. GIHON, M. D.....	1884
*JAMES E. REEVES, M. D.....	1885
HENRY P. WALCOTT, M. D.....	1886
GEORGE M. STERNBERG, M. D.....	1887
CHARLES N. HEWITT, M. D.....	1888
*HOSMER A. JOHNSON, M. D.....	1889
HENRY B. BAKER, M. D.....	1890
FREDERICK MONTIZAMBERT, M. D.....	1891
FELIX FORMENTO, M. D.....	1892
SAMUEL H. DURGIN, M. D.....	1893
EMMANUEL P. LACHAPELLE, M. D.....	1894
WILLIAM BAILEY, M. D.....	1895
EDUARDO LICEAGA, M. D.....	1896
*HENRY B. HORLBECK, M. D.....	1897
CHARLES A. LINDSLEY, M. D.....	1898
*GEORGE H. ROHE, M. D.....	1899
HENRY MITCHELL, M. D.....	1899
PETER H. BRYCE, M. D.....	1900
BENJAMIN LEE, M. D.....	1901
HENRY D. HOLTON, M. D.....	1902
WALTER WYMAN, M. D.....	1903
CARLOS J. FINLAY, M. D.....	1904
F. F. WESBROOK, M. D.....	1905

* Deceased.

STANDING COMMITTEES.

EXECUTIVE COMMITTEE.

[The Officers and Ex-Presidents of the Association and the Chairman, Secretary and retiring Chairman of the Laboratory Section are ex-officio members of the Executive Committee.]

ELECTIVE MEMBERS.

DR. MARCUS HAASE.....	Memphis, Tenn.
DR. CHARLES V. CHAPIN.....	Providence, R. I.
DR. WM. C. CHAPMAN.....	Toledo, Ohio.
DR. JUAN GUITERAS.....	Havana, Cuba.
PROF. H. L. RUSSELL.....	Madison, Wis.
DR. WM. C. WOODWARD.....	Washington, D. C.

PUBLICATION COMMITTEE.

DR. JOSIAH HARTZELL.....	Canton, Ohio.
DR. C. O. PROBST.....	Columbus, Ohio.
DR. FRANK W. WRIGHT.....	New Haven, Conn.
DR. HERBERT D. PEASE.....	Albany, N. Y.

The President ex-officio Member.

ADVISORY COUNCIL.

UNITED STATES:

Alabama	
Alaska	
Arkansas	
Arizona	
California	DR. A. J. RICE, <i>San Francisco.</i>
Colorado	
Connecticut	DR. C. A. LINDSLEY, <i>New Haven.</i>
Delaware	
Florida	DR. J. Y. PORTER, <i>Jacksonville.</i>
Georgia	
Hawaii	
Idaho	
Illinois	DR. LISTON H. MONTGOMERY, <i>Chicago.</i>
Indiana	DR. FRED A. TUCKER, <i>Noblesville.</i>
Iowa	DR. R. E. CONNIFF, <i>Sioux City.</i>
Kansas	
Kentucky	DR. WILLIAM BAILEY, <i>Louisville.</i>
Louisiana	DR. QUITMAN KOHNKE, <i>New Orleans.</i>
Maine	PROF. F. C. ROBINSON, <i>Brunswick.</i>

STANDING COMMITTEES.

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Maryland	DR. W. R. STOKES, <i>Baltimore.</i>
Massachusetts	DR. S. H. DURGIN, <i>Boston.</i>
Michigan	C. E. MARSHALL, <i>Agricultural College.</i>
Minnesota	DR. HENRY M. BRACKEN, <i>St. Paul.</i>
Mississippi	DR. H. McM. FOLKES, <i>Bilosi.</i>
Missouri	DR. H. WHEELER BOND, <i>St. Louis.</i>
Montana	
Nebraska	
Nevada	
New Hampshire	DR. G. P. CONN, <i>Concord.</i>
New Jersey	DR. H. C. H. HEROLD, <i>Newark.</i>
New Mexico	
New York	DR. WALTER D. GREENE, <i>Buffalo.</i>
North Carolina	DR. R. H. LEWIS, <i>Raleigh.</i>
North Dakota	DR. H. D. QUARRY, <i>Grand Forks.</i>
Ohio	DR. FRANK WARNER, <i>Columbus.</i>
Oklahoma Territory ...	
Oregon	
Pennsylvania	DR. J. E. MEARS, <i>Philadelphia.</i>
Philippine Islands	DR. WM. E. MUSGRAVE, <i>Manila.</i>
Porto Rico	
Rhode Island	DR. A. B. BRIGGS, <i>Ashaway.</i>
South Carolina	DR. CHAS. M. REES, <i>Charleston.</i>
South Dakota	
Tennessee	DR. MARCUS HAASE, <i>Memphis.</i>
Texas	DR. J. H. SMART, <i>Dallas.</i>
Utah	DR. T. B. BEATTY, <i>Salt Lake City.</i>
Vermont	DR. H. D. HOLTON, <i>Brattleboro.</i>
Virginia	DR. E. C. LEVY, <i>Richmond.</i>
Washington	DR. JAMES B. EAGLESON, <i>Seattle.</i>
West Virginia	DR. JAMES H. BROWNFIELD, <i>Fairmont.</i>
Wisconsin	DR. C. A. HARPER, <i>Madison.</i>
District of Columbia...	DR. WM. C. WOODWARD, <i>Washington.</i>
U. S. Army.....	DR. JAMES CARROLL, <i>Washington.</i>
U. S. Navy.....	DR. DWIGHT DICKINSON, <i>Portsmouth, N. H.</i>
U. S. P. H. and M. H.	
Service	DR. P. H. BAILHACHE, <i>Washington, D. C.</i>

CANADA:

Dominion of Canada...	DR. FREDERICK MONTIZAMBERT, <i>Ottawa.</i>
British Columbia	DR. J. C. FAGAN, <i>Victoria.</i>
Ontario	DR. C. A. HODGETTS, <i>Toronto.</i>
Quebec	DR. GEORGE J. ADAMI, <i>Montreal.</i>
Manitoba	DR. A. J. DOUGLAS, <i>Winnipeg.</i>
New Brunswick	DR. E. BAYARD FISHER, <i>Fredericton.</i>
Nova Scotia	

CUBA:

Republic of Cuba.....	DR. JUAN GUITERAS, <i>Havana.</i>
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MEXICO:

Aguas Calientes	DR. A. PRUNEDA, <i>Mexico, D. F.</i>
Campeche	DR. DOMINGO ORVANANOS, <i>Mexico, D. F.</i>
Colima	DR. LUIS E. RUIZ, <i>Mexico, D. F.</i>
Coahuila	DR. DAVID CERNA, <i>Saltillo.</i>
Chihuahua	DR. MIGUEL MARQUEZ, <i>Chihuahua.</i>
Chiapas	
Durango	DR. JOSE L. GOMEZ, <i>Mexico, D. F.</i>
Guanajuato	DR. JESUS CHICO, <i>Guanajuato City.</i>
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Michoacan	DR. FRANCISCO BERNALDEZ, <i>Mexico, D. F.</i>
Morelos	DR. FERNANDO LOPEZ, <i>Mexico, D. F.</i>
Mexico	DR. IGNACIO GUZMAN, <i>Toluca.</i>
Nuevo Leon	DR. AMADO TERNANDER, <i>Monterey.</i>
Oaxaca	DR. ALBERTO CARRIEDO, <i>Oaxaca.</i>
Puebla	DR. EMILIO J. BONILLO, <i>Puebla.</i>
Queretaro	DR. MANUEL SEPTIEN, <i>Queretaro.</i>
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Tobasco	DR. GONZALES FABELA, <i>Mexico, D. F.</i>
Tamaulipas	DR. ANTONIO MATIENZO, <i>Tampico.</i>
Tlaxcala	DR. JOSE GAYON, <i>Mexico, D. F.</i>
Veracruz	DR. MANUEL IGLESIAS, <i>Veracruz.</i>
Yucatan	DR. AUGUSTIN CHACON, <i>Mexico, D. F.</i>
Zacatecas	DR. JUAN BRENA, <i>Zacatecas.</i>
Territorio de la Baja	
California	DR. JOSE D. MORALES, <i>Mexico, D. F.</i>
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AMERICAN PUBLIC HEALTH ASSOCIATION.

1905.

This list includes those who have maintained their membership to the present time, counting those joining in 1905. The Secretary should be notified of any errors or omissions.

MEMBERS.

ACOSTA, ENRIQUE, M. D.....	105 Prado St., Havana, Cuba.	1904
ADAMS, J. F. A., M. D.....	Pittsfield, Mass.	1881
*AGRAMONTE, ARISTIDES, M. D.....	15 Vedado St., Havana, Cuba.	1904
ALBARRAN, PEDRO, M. D.....	58 Bernaza St., Havana, Cuba.	1904
ALBERTINI, A. DIAZ, M. D.....	111 Habana St., Havana, Cuba.	1904
ALENAN, JOSE M., M. D.....	Havana, Cuba.	1904
ALEXANDER, EDWARD, M. D.....	El Paso, Texas.	1892
ALVORD, J. W., C. E.....	127 Hartford Building, Chicago, Ill.	1899
AMHERST COLLEGE LIBRARY.....	Amherst, Mass.	1901
*AMYOT, JNO. A., M. D.....	30 St. Joseph St., Toronto, Ont.	1900
*ANDERSON, JOHN F., M. D., U. S. P. H. and M. H. S.,	Washington, D. C.	1903
ARMAS, JULIAN, M. D.....	63 Reina St., Havana, Cuba.	1904
ARMENT, SAMUEL B., M. D.....	Bloomsburg, Pa.	1901
AROSTEGUI, GONZALO, M. D.....	23 Amargura St., Havana, Cuba.	1904
ARTEAGA, JULIO F., M. D.....	139 J. S. Rafael, Havana, Cuba.	1904
ASHFORD, BAILLY K., M. D.....	U. S. Army, Washington, D. C.	1904
*BADGER, ERNEST F.....	48 Weybosset St., Providence, R. I.	1900
BAGGS, A. N., M. D.....	Abington, Pa.	1901
BAILEY, WILLIAM, M. D.....	215 Broadway, Louisville, Ky.	1879
BAILHACHE, P. H., M. D., P. H. and M. H. S.....	Stapleton, N. Y.	1874
BALL, CHARLES B., C. E.....	118 Hazel Ave., Chicago, Ill.	1903
BALLOU, REV. HENRY L.....	Chester, Vermont.	1904
BARBOUR, FRANK A., C. E.....	1121 Tremont Bldg., Boston, Mass.	1900
BARNES, HENRY JABEZ, M. D.....	429 Beacon St., Boston, Mass.	1896
BARNETT, ENRIQUE B., M. D.....	29 St. Rafael St., Havana, Cuba.	1904
BARROSA, LUIS, M. D.....	44 Amargura St., Havana, Cuba.	1904
BARTLETT, JAMES W.....	Dover, N. H.	1888
BARTOL, JOHN W., M. D.....	48 Chestnut St., Boston, Mass.	1904
BASHORE, HARVEY B., M. D.....	West Fairview, Pa.	1897
BATTLE, SAMUEL W., M. D.....	Asheville, N. C.	1887
BAZAN, VIRGILIO DE ZAYAS, D. D. S.....	95 Obispo St., Havana, Cuba.	1904
BEATTY, T. B., M. D.....	509 E. First St., Salt Lake City, Utah.	1904
*BECKMAN, E. H., M. D.....	929 Chicago Ave., Minneapolis, Minn.	1904

* Also members of Section of Bacteriology and Chemistry.

BEEBE, HENRY E., M. D.	Sidney, Ohio.	1882
BELL, A. N., M. D.	337 Clinton St., Brooklyn, N. Y.	1872
*BELL, GORDON, M. D.	Winnipeg, Manitoba.	1899
BENNETT, FRANCIS M., M. D.	137½ State St., Springfield, Mass.	1901
BERNALDEZ, FRANCISCO, M. D.	Estampa-Merced 5, Mexico, Mex.	1892
BESHOAR, BENJAMIN B., M. D.	Trinidad, Col.	1903
BESHOAR, MICHAEL, M. D.	Trinidad, Col.	1895
*BEVIER, PROF. ISABEL.	University of Illinois, Urbana, Ill.	1900
*BEYER, HENRY E., M. D.	Hotel Albany, Washington, D. C.	1904
*BEYER, PROF. GEORGE E.	Tulane University, New Orleans, La.	1902
BISBAL, CARLOS L., M. D.	Farmacia S. Isabel, Havana, Cuba.	1904
*BISSELL, WM. G., M. D.	143 Elmwood Ave., Buffalo, N. Y.	1900
BOARDMAN, WM. FREARS.	Department of Interior, Ottawa, Ont.	1898
BOARD OF HEALTH.	Manchester, N. H.	1899
*BOLLING, GEO. E.	17 Gifford St., Brockton, Mass.	1900
BOND, H. WHEELER, M. D.	17 Vanderwenter St., St. Louis, Mo.	1903
BOSQUE, A. C., M. D.	36 Tejadillo St., Havana, Cuba.	1904
BRACKEN, H. M., M. D.	514 Pioneer Press Bldg., St. Paul, Minn.	1895
BRACKETT, C. F., M. D.	Princeton, N. J.	1899
BRAND, W. W., M. D.	216 Michigan Ave., Toledo, Ohio.	1901
BRAUNNAGEL, JULIUS, M. D.	Box 925, San Antonio, Tex.	1890
BRENA, JUAN, M. D.	Zacatecas, Mex.	1898
BREWER, PROF. WILLIAM H., M. D.	New Haven, Conn.	1874
BROWN, GEORGE, M. D.	Atlanta, Ga.	1902
BROWNFIELD, JAMES H., M. D.	321 Main St., Fairmont, W. Va.	1902
BRUSH, EDWARD F., M. D.	Mt. Vernon, N. Y.	1903
BRYANT, WILLIAM S., M. D.	48 40th St., New York, N. Y.	1904
BRYCE, PETER H., M. D.	Department of Interior, Ottawa, Ont.	1883
BURROUGHS, JAS. A., M. D.	Asheville, N. C.	1898
BUTTERFIELD, F. C.	Derby Line, Vt.	1902
*BUXTON, BERTRAM H., M. D.	1 West 101st St., New York, N. Y.	1901
*CAIRD, JAMES M.	271 River St., Troy, N. Y.	1900
CALVES, FERNANDO, M. D.	43 St. Ignacio St., Havana, Cuba.	1904
CAMERON, J. CHALMERS, M. D.	941 Dorchester St., Montreal, P. Q.	1894
CAMPBELL, ALEXANDER MCKENZIE, M. D.	Grand Rapids, Mich.	1903
CAMPBELL, EDW. R., M. D.	Bellows Falls, Vt.	1902
CANALS, JOSE ANTONIO, C. E.	San Juan, Porto Rico.	1904
CANTRELL, GEO. M. D., M. D.	116 Louisiana St., Little Rock, Ark.	1902
CAPOTE, FERNANDO MENDEZ, M. D.	72 St. Miguel St., Havana, Cuba.	1904
CARNEGIE LIBRARY	Pittsburg, Pa.	1902
*CARROLL, JAMES, M. D.	Washington, D. C.	1903
CARTER, HENRY R., M. D.	Ancon, C. Z.	1902
CASANOVA, JOSE N., M. D.	Malecon H 2, Havana, Cuba.	1904
CASTELLANOS, MANUEL S., M. D.	124 Escobar St., Havana, Cuba.	1904
CAPELLIER, LAURENT, M. D.	Quebec, Que.	1904
CAVERLY, CHARLES S., M. D.	Rutland, Vt.	1894
CHABAU, LORENZO, M. D.	43 St. Ignacio St., Havana, Cuba.	1904
CHAILLE, PROF. STANFORD E.	P. O. Drawer 261, New Orleans, La.	1874

* Also members of Section of Bacteriology and Chemistry.

*CHAMOT, E. M.	Cornell University, Ithaca, N. Y.	1903
CHANDLER, PROF. C. F.	Columbia College, New York, N. Y.	1872
CHANDLER, DAVID D.	74 North 7th St., Newark, N. J.	1896
CHAPIN, CHARLES V., M. D.	Providence, R. I.	1886
CHAPMAN, W. C., M. D.	1710 Madison St., Toledo, Ohio.	1900
CHASE, H. LINCOLN, M. D.	Brookline, Mass.	1895
CHASE, JOHN C., C. E.	Derry, N. H.	1890
CHASSAIGNAC, CHARLES, M. D.	890 Canal St., New Orleans, La.	1904
CHICO, JESUS, M. D.	2 Estrella St., Guanajuato City, Guanajuato, Mex.	1891
CHURCH, THOMAS TEASDALE, M. D.	70 E. Main St., Salem, Ohio.	1890
*CLARK, HARRY W.	Room 502, State House, Boston, Mass.	1896
COFFEY, JAMES C.	Worcester, Mass.	1896
CONN, G. P., M. D.	Concord, N. H.	1875
*CONNELL, WALTER THOMAS, M. D.	Kingston, Ont.	1898
*CONNOLLY, R. N., M. D.	City Hospital, Newark, N. J.	1898
CONNER, P. S., M. D.	215 West Ninth St., Cincinnati, O.	1884
COOK, J. T., M. D.	636 Delaware Ave., Buffalo, N. Y.	1901
*COPLIN, WILLIAM L.	1629 South Broad St., Philadelphia, Pa.	1897
COOPS, FRANK H., M. D.	449 Washington Ave., Bridgeport, Conn.	1904
CORBETT, J. F., M. D.	2446 Park Ave., Minneapolis, Minn.	1899
CORDOVA, FEDERICO, M. D.	32 Virtudes St., Havana, Cuba.	1904
CORDOVA, MATILDE.	32 Virtudes St., Havana, Cuba.	1904
*COSTER, W. H.	Sixth Ave. and Cherry Alley, Pittsburgh, Pa.	1901
COWING, HUGH A., M. D.	210 High St., Muncie Ind.	1900
COX, EDGAR, M. D.	13½ West Mulberry St., Kokomo, Ind.	1900
CRAIG, G. G., M. D.	Rock Island, Ill.	1880
CRANDALL, WM. S.	309 Broadway, New York, N. Y.	1901
CRANE, WILLIAM HENRY, M. D.	20 West Ninth St., Cincinnati, O.	1903
CROES, J. JAMES R., C. E.	68 Broad St., New York, N. Y.	1877
CURTIS, FRANCIS GEORGE, M. D.	West Newton, Mass.	1897
CURTIS, F. C., M. D.	17 Washington Ave., Albany, N. Y.	1883
DAREY, J. HERBERT, M. D.	504 Metropolitan Block, Sioux City, Iowa.	1904
DAVIS, CLARK W., M. D.	902 Elm St., Cincinnati, Ohio.	1903
*DAVIS, FLOYD, PH. D.	Des Moines, Ia.	1890
DE ARAGON, ERNESTO, M. D.	59 Salud St., Havana, Cuba.	1904
DE GARAY, ADRIAN, M. D.	No. 4 Leon, Mexico City, Mex.	1904
DEHOGUES, JORGE L., M. D.	96 Aguila St., Havana, Cuba.	1904
DE LA GUARDIA, VICENTE, M. D.	19 y D. Vedado St., Havana, Cuba.	1904
DE LEON, ABELARDO, M. D.	150 Compostella St., Havana, Cuba.	1904
DELFIN, MANUEL, M. D.	120 A Industria St., Havana, Cuba.	1904
DELGADO, CLAUDIO, M. D.	503 Monte St., Havana, Cuba.	1904
DE LOS REYES, GUSTAVO, M. D.	72 Neptuno St., Havana, Cuba.	1904
*DENNY, F. P., M. D.	Brookline, Mass.	1901
DENNIS, LABAN, M. D.	30 Central St., Newark, N. J.	1877
DE QUESADA, GREGORIO J., M. D.	83 Trocadero St., Havana, Cuba.	1904
DEL RIO, NARCISO, M. D.	Vera Cruz, Mex.	1904
DEL VALLE, JOSE ANTONIO LOPEZ, M. D.	44 Gallano St., Havana, Cuba.	1904
*DE SALAZAR, G., M. D.	7 Tulipan St., Havana, Cuba.	1904

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DE VELASCO, FRANCISCO JAVIER, M. D.	14 Trocadero St., Havana, Cuba.	1904
DISEROW, WM. S., M. D.	151 Orchard St., Newark, N. J.	1899
*DODGE, CHARLES WRIGHT.	University of Rochester, Rochester, N. Y.	1901
DOMINGUEZ, A. S., M. D.	40 Consulado St., Havana, Cuba.	1904
DOMINGUEZ, GUILLERONO, M. D.	33 Prado St., Havana, Cuba.	1904
*DONALDSON, WELLINGTON.	Knoxville, Tenn.	1903
*DORSET, MARION, M. D.	Bureau Animal Industry, Washington, D. C.	1900
DOTY, ALVAH H., M. D.	Rosebank, N. Y.	1896
DOUGLAS, ALEXANDER JOSEPH, M. D.	Winnipeg, Manitoba.	1903
DUDLEY, CHARLES P., M. D.	Altoona, Pa.	1888
DUENAS, JOAQUIN L., M. D.	16 Trocadero St., Havana, Cuba.	1904
DUQUE, MATIAS, M. D.	22 Campanario St., Havana, Cuba.	1904
DURGIN, SAMUEL H., M. D.	12 Beacon St., Boston, Mass.	1875
DYER, ISADORE, M. D.	124 Baronne St., New Orleans, La.	1902
EAGLESON, JAMES B., M. D.	512 Burke Building, Seattle, Wash.	1896
EARL, GEORGE GOODELL.	602 Carondelet St., New Orleans, La.	1902
EATON, J. M., M. D.	Carberry, Manitoba.	1901
ECHARTE, EDUARDO, M. D.	113 Cuba St., Havana, Cuba.	1904
*EDGAR, THOMAS OSCAR.	2251 Calumet Ave., Chicago, Ill.	1904
EGAN, J. A., M. D.	Springfield, Ill.	1897
EGBERT, SENECA, M. D.	17th and Cherry Sts., Philadelphia, Pa.	1901
*ELGIN, W. F., M. D.	Glenolden, Pa.	1900
ELIOT, LLEWELLYN, M. D.	1106 P. St. N. W., Washington, D. C.	1902
*ELMS, J. W.	East Court and Martin Sts., Cincinnati, Ohio.	1897
ELSNER, JOHN, M. D.	P. O. Box 454, Denver, Col.	1887
EMBICH, MILTON A.	Boiling Springs, Pa.	1903
*EMERSON, H. C., M. D.	11 Maple St., Springfield, Mass.	1899
*ERNST, HAROLD C., M. D.	Harvard Medical School, Boston, Mass.	1899
EVANS, JOSEPH S., JR., M. D.	Univ. of Pa., Philadelphia, Pa.	1903
EXTON, JAMES A., M. D.	75 Beech St., Arlington, N. J.	1897
*FABELO, OCTAVINO GONZALES, M. D.,	10 Calle de la Violetta, No. 6, Mexico, Mex.	1901
FAGAN, C. J., M. D.	Victoria, B. C.	1901
FALES, FRANK L., C. E.	City Hall, Cincinnati, Ohio.	1893
FARNHAM, EDWIN, M. D.	Cambridge, Mass.	1889
FARQUHAR, A. B., Esq.	York, Pa.	1880
FARRES, RICARDO, M. D.	105 Prado St., Havana, Cuba.	1904
FERGUSON, F., M. D.	20 W. 38th St., New York, N. Y.	1892
FERNANDEZ, JUAN SANTOS, M. D.	105 Prado St., Havana, Cuba.	1904
FERRAN, JOSE, M. D.	100 Prado St., Havana, Cuba.	1904
FINLAY, CARLOS JUAN, M. D.	128 Reina St., Havana, Cuba.	1902
FINLAY, C. E., M. D.	128 Reina St., Havana, Cuba.	1904
FISHER, E. B., M. D.	Frederickton, N. B.	1901
FISHER, PROF. IRVING.	New Haven, Conn.	1903
FLICK, LAWRENCE F., M. D.	732 Pine St., Philadelphia, Pa.	1890
*FLOCKEN, CHARLES F., D. V. M.	Hospital Las Animas, Havana, Cuba.	1904
FOGARTY, JOSEPH NORMAN, M. D.	227 Duval St., Key West, Fla.	1902

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*FOOTE, CHARLES JENKINS, M. D.	26 Elm St., New Haven, Conn.	1895
FORMENTO, FELIX, M. D.	735 Esplanade Ave., New Orleans, La.	1880
FORWOOD, WILLIAM H., M. D.	1425 Euclid Place, Washington, D. C.	1908
FRANCIS, CHARLES, C. E.	8 Masonic Temple, Davenport, Ia.	1903
*FREEMAN, R. G., M. D.	478 W. 59th St., New York, N. Y.	1899
*FROST, WILLIAM DODGE, PH. D.	310 N. Bruen St., Madison, Wis.	1904
*FULLER, GEORGE W.	170 Broadway, New York, N. Y.	1892
*FULTON, JOHN S., M. D.	10 South St., Baltimore, Md.	1897
FURNISS, HENRY W., M. D.	Bahia, Brazil.	1900
GABLE, ISAAC C., M. D.	26 South St., York, Pa.	1897
*GAGE, STEPHEN DE M.	Experiment Station, Lawrence, Mass.	1901
GARCIA, GABRIEL M., M. D.	113 Cuba St., Havana, Cuba.	1904
*GEHRMANN, ADOLPH, M. D.	3816 Ellis St., Chicago, Ill.	1895
GEMMILL, W. T., M. D.	Forest, Ohio.	1900
GERHARD, WM. PAUL, C. E.	33 Union Square West, New York, N. Y.	1880
GERRISH, FREDERIC H., M. D.	Portland, Me.	1885
*GILLILAND, S. H., M. D.	Univ. of Pa., Philadelphia, Pa.	1900
GOLDWATER, S. S., M. D.	Mt. Sinai Hospital, New York, N. Y.	1902
GOLER, GEO. W., M. D.	127 East Ave., Rochester, N. Y.	1900
GOODRIDGE, E. A., M. D.	63 Jamaica Ave., Flushing, N. Y.	1900
GORGAS, WM. C., M. D., U. S. A.	Ancon, C. Z.	1901
*GORHAM, FRED. P.	Brown University, Providence, R. I.	1899
GRAVES, E. E., M. D.	Penacook, N. H.	1886
GRAY, SAMUEL M., C. E.	10 Weybosset St., Providence, R. I.	1891
GREEN, J. MERCIER, M. D.	Charleston, S. C.	1902
GREENE, WALTER D., M. D.	385 Jersey St., Buffalo, N. Y.	1902
GRUBBS, SAMUEL BATES, M. D.	U. S. Marine Hospital, Chicago, Ill.	1902
GUERRERO, AMANDO, M. D.	16 Consulado St., Havana, Cuba.	1904
GUITERAS, JUAN, M. D.	119 San Miguel St., Havana, Cuba.	1902
GUITERAS, RAMON, M. D.	75 West 55th St., New York, N. Y.	1904
HAASE, MARCUS, M. D.	1261 Peabody Ave., Memphis, Tenn.	1902
HAGEY, JACOB MOYER, M. D.	Mt. Morris, N. Y.	1892
HAIGH, HENRY A., ESQ.	47 Alexandrine Ave., Detroit, Mich.	1901
*HARRINGTON, CHARLES, M. D.	State House, Boston, Mass.	1901
*HARRIS, NORMAN, McL., M. D.	University of Chicago, Chicago, Ill.	1899
HARPER, C. A., M. D.	15 Pinckney St., Madison, Wis.	1904
*HARRISON, F. C. S., M. D.	Guelph, Ont.	1901
HARTZELL, JOSIAH, PH. D.	Canton, Ohio.	1895
HARVARD COLLEGE LIBRARY	Cambridge, Mass.	1900
HASKELL, W. A., M. D.	Alton, Ill.	1883
HAWKINS, R. G., M. D.	Palmetto, La.	1902
HAWLEY, D. C., M. D.	Burlington, Vt.	1904
HAYOS, CANDIDO, M. D.	122 San Miguel St., Havana, Cuba.	1904
*HAZEN, ALLEN, C. E.	220 Broadway, New York, N. Y.	1892
HENGERER, WILLIAM	Buffalo, N. Y.	1896
HERSHEY, MILTON H.	Montreal, Que.	1903
HERING, RUDOLPH, C. E.	170 Broadway, New York, N. Y.	1878

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HEROLD, H. C. H., M. D.....	Newark, N. J.	1898
HILL, G. EVERETT, C. E.....	156 Fifth Ave., New York, N. Y.	1897
*HILL, HIBBERT W., M. D.....	Univ. of Minn., Minneapolis, Minn.	1896
HILL, JOHN EDW.....	Brown Univ., Providence, R. I.	1902
HILL, JOHN W., C. E.....	1st Nat. Bank Bldg., Cincinnati, Ohio.	1896
*HISS, PHILIP H., JR., M. D.....	437 W. 59th St., New York, N. Y.	1899
*HODENPYL, EUGENE, M. D.....	437 W. 59th St., New York, N. Y.	1901
*HOLLIS, FREDERICK S.....	29 Norton St., New Haven, Conn.	1902
HOLTON, HENRY D., M. D.....	Brattleboro, Vt.	1875
*HORTON, ELMER G., B. S.....	Columbus, Ohio.	1897
HOWE, O. E., M. D.....	601 H St. N. W., Washington, D. C.	1904
*HUDDLESTON, J. H., M. D.....	126 W. 85th St., New York, N. Y.	1899
HUNT, C. C., M. D.....	Dixon, Ill.	1889
HURTY, JOHN N., M. D.....	29 E. Second St., Indianapolis, Ind.	1896
HUTCHINSON, HENRY, M. D....	703 Germania Life Bldg., St. Paul, Minn.	1904
IGLESIAS, MANUEL S., M. D.....	Veracruz, Mex.	1900
*JACKSON, DANIEL D., Flatbush Ave. and Eastern Parkway, Brooklyn, N. Y.		1899
JACOBSEN, JOAQUIN L., M. D.....	2 Monserrate St., Havana, Cuba.	1904
JAIME, OSCAR, M. D.....	147 Animas St., Havana, Cuba.	1904
JENKINS, WM. T., M. D.....	Maryland Ave., New York, N. Y.	1904
JOHNSON, CHAS. B., M. D.....	Champaign, Ill.	1897
*JOHNSON, GEO. A.....	170 Broadway New York, N. Y.	1900
JOHNSON, H. L. E., M. D....	1821 Jefferson Place, Washington, D. C.	1903
JONES, HEBER, M. D.....	Memphis, Tenn.	1902
JONES, LEANDER P., M. D.....	Greenwich, Conn.	1889
*JORDAN, EDWIN O.....	University of Chicago, Chicago, Ill.	1899
*JORDAN, HARRY E.....	835 Cairo St., Indianapolis, Ind.	1904
JORDAN, THOMAS, M. D.....	Board of Health, Boston, Mass.	1902
KELLOGG, J. H., M. D.....	Battle Creek, Mich.	1878
*KENDALL, ARTHUR I.....	1020 N. Broadway, Baltimore, Md.	1902
KENNEDY, J. F., M. D.....	Des Moines, Iowa.	1885
KING, WILLIAM A.....	Census Bureau, Washington, D. C.	1901
*KINNICUTT, LEONARD P., S. D.....	Worcester, Mass.	1899
*KINYOUN, J. J., M. D.....	Glenolden, Pa.	1902
KINNEY, ALFRED, M. D.....	Astoria, Ore.	1903
*KNEASS, S. S., M. D.....	1510 Walnut St., Philadelphia, Pa.	1899
*KNOWLES, MORRIS, C. E.....	Bureau of Filtration, Pittsburg, Pa.	1901
KNOX, S. P. B., M. D.....	912 Anacapa, Santa Barbara, Cal.	1892
KNOX, WILLIAM F., M. D.....	McKeesport, Pa.	1887
KOBER, GEORGE M., M. D.....	1600 T St., Washington, D. C.	1896
KOHLY, CHARLES E., M. D.....	473 Monte St., Havana, Cuba.	1904
KOHN, JOSEPH.....	500 Canal St., New Orleans, La.	1902
KOHNKE, QUITMAN, M. D....	1815 St. Andrews St., New Orleans, La.	1902
KOON, THOMAS M., M. D.....	Grand Rapids, Mich.	1903
KORNEMANN, H. A., M. D.....	262 15th Ave., Newark, N. J.	1904

* Also members of Section of Bacteriology and Chemistry.

KUICHLING, EMIL, C. E.	52 Broadway, New York, N. Y.	1882
LACHAPELLE, E. PERSILLIER, M. D.	Montreal, P. Q.	1887
LAINÉ, D. T., M. D.	70 Prado St., Havana, Cuba.	1904
LEAL, FRANCES DE P., M. D.	6 2d. San Lorenzo, Mexico, Mex.	1903
LEAL, JOHN LAINY, M. D.	149 Ellison St., Paterson, N. J.	1891
LEARNED, JOHN B., M. D.	Northampton, Mass.	1889
*LEBREDO, MARIO G., M. D.	Las Animas Hospital, Havana, Cuba.	1904
LEE, BENJAMIN, M. D.	1420 Chestnut St., Philadelphia, Pa.	1874
LEE, RICARDO GUTIERREZ, M. D.	85 Reina St., Havana, Cuba.	1904
*LEIGHTON, MARSHALL O.	U. S. G. S., Washington, D. C.	1897
*LEVY, ERNEST C., M. D.	Dept. Water Supply, Richmond, Va.	1904
LEWIS, DANIEL, M. D.	249 Madison Ave., New York, N. Y.	1894
LEWIS, RICHARD H., M. D.	Raleigh, N. C.	1892
LICEAGA, EDUARDO, M. D.	4 San Andres St., Mexico, Mex.	1891
LINDSLEY, CHARLES A., M. D.	New Haven, Conn.	1875
LINDSLEY, J. M., M. D.	272 Manhattan Ave., New York, N. Y.	1902
LINN, ALEX. M., M. D.	218 Sixth Ave., Des Moines, Iowa.	1902
LOPEZ, FERNANDO, M. D.	Mexico City, Mex.	1901
LOREDO, FRANCISCO, M. D.	98 Concordia St., Havana, Cuba.	1904
LUDLOW, JACOB LOTT, C. E.	Winston-Salem, N. C.	1903
LUMBIER, DANIEL MUNOZ, M. D.	1205 Ygnacio Ramirez, Chihuahua, Mex.	1904
LUMSDEN, W. J., M. D.	Elizabeth City, N. C.	1892
LYONS, ROBERT E.	630 East Third St., Bloomington, Ind.	1900
MACDONALD, A. E., M. D.	431 Riverside Drive, New York, N. Y.	1904
MACDONALD, GEORGE, M. D.	118 Angus Ave., Calgary, Alberta, Can.	1904
MACDONALD, JNO. A., M. D.	Brandon, Manitoba.	1900
MCCLELLAND, J. H., M. D.	Fifth and Wilkins Ave., Pittsburg, Pa.	1885
MCCORMACK, J. N., M. D.	Bowling Green, Ky.	1880
*MCFARLAND, JOSEPH, M. D.	447 Stafford St., Germantown, Pa.	1897
MCKENZIE, T. H., C. E.	Southington, Conn.	1904
MCLAUGHLIN, GEO. E., M. D.	41 Crescent Ave., Jersey City, N. J.	1901
MAGENNIS, BRYAN C., M. D.	Bridge St., Paterson, N. J.	1900
MAIGNEN, P. A.	1310 Arch St., Philadelphia, Pa.	1902
MARCHAND, CHARLES.	57 Prince St., New York, N. Y.	1900
MARCLEY, WALTER J., M. D.	Rutland, Mass.	1904
MARQUEZ, MIGUEL, M. D.	Oficiiana Calle 49, Chihuahua, Mex.	1896
MARSH, E. J., M. D.	600 Park Ave., Paterson, N. J.	1872
MARSH, GEO. F.	Chester, Vt.	1904
MARSHALL, CHARLES E.	Agricultural College, Mich.	1901
MASSACHUSETTS INSTITUTE OF TECHNOLOGY.	Boston, Mass.	1901
MATTHEWS, W. E., M. D.	425 Lincoln St., Johnstown, Pa.	1897
MAYER, FRED. J., M. D.	Scott, La.	1902
MEAD, DANIEL WEBSTER, C. E.	1st National Bank Bldg., Chicago, Ill.	1892
MEAD, JULIAN AUGUSTUS, M. D.	Irving St., Watertown, Mass.	1896
MEEHAN, J. H., M. D.	432 Third St., Niagara Falls, N. Y.	1901
MENOCAL, D. LUIS, M. D.	46 Concordia St., Havana, Cuba.	1904
MENOCAL, FRANCISCO E., M. D.	Machina St., Havana, Cuba.	1904

* Also members of Section of Bacteriology and Chemistry.

REVISED LIST OF MEMBERS.

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MESTRE, ARISTIDES, M. D.....	136 Linea St., Havana, Cuba.	1904
*METZ, ABRAHAM L., M.D., Medical Dept. Tulane Univ., New Orleans, La.		1902
MILLER, WM. T., M. D.....	260 Euclid Ave., Cleveland, Ohio.	1902
MIRANDA, R. L., M. D.....	12 West 102d St., New York, N. Y.	1904
MITCHELL, HENRY, M. D.....	Asbury Park, N. J.	1886
MOAT, CHARLES P.....	Burlington, Vt.	1903
MOHR, CHARLES, M. D.....	Oak Lane, Philadelphia, Pa.	1897
*MONJARRAS, JESUS E., M. D.....	2 a de Yturvide No. 1, Mexico, D. F.	1891
MONJEAU, C., C. E.....	Middletown, Ohio.	1887
MONTGOMERY, L. H., M. D.....	92 State St., Chicago, Ill.	1879
MONTIZAMBERT, FREDERICK, M. D.....	Ottawa, Ont.	1885
MOORE, CARROLL A.....	Bellows Falls, Vt.	1904
MOORE, RICHARD C., M. D.....	312 McCague Bldg., Omaha, Neb.	1904
*MOORE, VERANUS A., M. D.....	Veterinary College, Ithaca, N. Y.	1896
MORAN, EMILIO B., M. D.....	324 J del Monte St., Havana, Cuba.	1904
MORENO, ANTONIO, M. D.....	72 Monte St., Havana, Cuba.	1904
MORGAN, DAVID PERCY.....	70 Park Ave., New York, N. Y.	1885
MORSE, W. F., S. E.....	25 Broad St., New York, N. Y.	1889
MOSHER, ELIZA M., M. D.....	44 Court St., Brooklyn, N. Y.	1889
MULFORD, HENRY K.....	412 So. 13th St., Philadelphia, Pa.	1896
MULLER, FRANCISCO, M. D.....	673 Cerro St., Havana, Cuba.	1904
NUNO, ADOLFO, M. D.....	31 Cuba St., Havana, Cuba.	1904
NAGLE, JOHN T., M. D.....	163 West 126th St., New York, N. Y.	1874
NEFF, J. S., M. D.....	Mutual Life Bldg., Philadelphia, Pa.	1897
NEWBURY LIBRARY.....	Chicago, Ill.	1901
NEWELL, F. H.....	U. S. Geological Survey, Washington, D. C.	1897
NEWMAN, G. A., M. D.....	New London, Minn.	1899
NEW YORK PUBLIC LIBRARY.....	40 Lafayette Place, New York, N. Y.	1898
NOLTE, ARTHUR, M. D.....	1505 State St., New Orleans, La.	1901
NUNN, R. J., M. D.....	5 York St. East., Savannah, Ga.	1881
*NUTTAL, GEORGE H. F., M. D.,		
3 Cranmer St., Pathological Laby, New Museum, Cambridge, Eng.		1891
OHAGE, JUSTUS, M. D.....	7th and Waconta Sts., St. Paul, Minn.	1899
OLIVA, ADOLFO, M. D.....	262 Hidalgo St., Guadalajara, Mexico.	1904
OTERO, J. M., M. D.....	30 Obispo St., Havana, Cuba.	1904
OTIS, EDWARD OSGOOD, M. D.....	381 Beacon St., Boston, Mass.	1894
OWEN, JAMES, C. E.....	Montclair, N. J.	1901
PARHAM, F. W., M. D.....	609 Macheca Bldg., New Orleans, La.	1902
*PARK, WM. H., M. D.....	315 W. 76th St., New York, N. Y.	1899
*PARKER, HORATIO N.....	U. S. G. S., Washington, D. C.	1900
PARMELEE, CHAS. L.....	136 Liberty St., New York, N. Y.	1899
PARRY, ELEANOR, M. D.....	749 Madison Ave., New York, N. Y.	1901
*PEARSON, LEONARD, V. M. D.....	3608 Pine St., Philadelphia, Pa.	1897
*PEASE, HERBERT D., M. D.....	116 Washington Ave., Albany, N. Y.	1897
PECK, GEORGE, M. D., U. S. N.....	926 North Broad St., Elizabeth, N. J.	1890
PEDRO, JUAN LUIS, M. D.....	68 Habana St., Havana, Cuba.	1904

* Also members of Section of Bacteriology and Chemistry.

PENA, JOSE M., M. D.	125 Manrique St., Havana, Cuba.	1904
PENNSYLVANIA R. R. RELIEF DEPT.	Philadelphia, Pa.	1899
*PERKINS, ROGER G., M. D.	1527 Euclid Ave., Cleveland, Ohio.	1902
PERRY, J. C., M. D.	U. S. P. H. and M. H. S., Washington, D. C.	1903
*PHELPS, EARLE B.	Mass. Inst. Tech., Boston, Mass.	1902
PIERCE, CLAUDE C., M. D.	P. H. and M. H. S., Mullett Key, Fla.	1902
PINA, MANUEL GARCIA, M. D.	Cordoba, Mex.	1902
PLA, JOSE A.	.69 Vedado 9th, Havana, Cuba.	1904
PLA, JUAN MIGUEL, M. D.	.69 Vedado 9th, Havana, Cuba.	1904
PLASENCIA, IGNACIO, M. D.	.50 Empedrado St., Havana, Cuba.	1904
*POLHAMUS, W. ELSON, M. D.	J. Vedado St., Havana, Cuba.	1904
PONCE, JORGE, M. D.	.88 San Lazaro St., Havana, Cuba.	1904
PONCE DE LEON, NESTOR J., M. D.	Havana, Cuba.	1904
*PORTER, JOHN LEWIS.	604 Carondelet St., New Orleans, La.	1902
PORTER, JOSEPH Y., M. D.	Jacksonville, Fla.	1878
POWELL, THOMAS, M. D.	416 West 6th St., Los Angeles, Cal.	1903
*PRESCOTT, SAMUEL C.	Mass. Institute Technology, Boston, Mass.	1902
PRICE, MARSHALL LANGTON, M. D.	10 South St., Baltimore, Md.	1903
PRIMELLES, BENJAMIN, M. D.	.15 Esquina St., Havana, Cuba.	1904
PROBST, C. O., M. D.	Columbus, Ohio.	1886
*PRUDDEN, T. MITCHELL, M. D.	.160 West 59th St., New York, N. Y.	1899
PRUNEDA, ALFONSO, M. D.	.2 Montealegre St., Mexico, Mexico.	1904
PULGARON, HECTOR A., M. D.	.86 Cuba St., Havana, Cuba.	1904
PUTNAM, HELEN C., M. D.	127 Angell St., Providence, R. I.	1901
*RAVENEL, M. P., M. D.	.908 Pine St., Philadelphia, Pa.	1897
RAYMOND, JOSEPH H., M. D.	.145 Willow St., Brooklyn, N. Y.	1882
REBELIN, HENRY, M. D.	.91 Jesus Maria St., Havana, Cuba.	1904
RENSOLI, FERNANDO, M. D.	.138 Neptuno St., Havana, Cuba.	1904
REYBURN, ROBERT, M. D.	.2129 F St., Washington, D. C.	1903
REYNOLDS, A. R., M. D.	French Lick, Ind.	1893
REYNOLDS, M. H., V. M. D.	St. Anthony Park, Minn.	1899
RICE, A. J., M. D.	.707 Mason St., San Francisco, Cal.	1902
RICHARD, CHARLES, M. D.	Manila, P. I.	1900
RICHARDS, EDGAR.	.16 Lafayette Sq., Washington, D. C.	1889
*RICHARDS, MRS. E. H.	Mass. Institute of Technology, Boston, Mass.	1888
RICHARDSON, MAJ. HENRY B., C. E.	New Orleans, La.	1880
RICHARDSON, W. L., M. D.	.225 Commonwealth Ave., Boston, Mass.	1875
*RICKARDS, BURT RANSOM, S. B.	.739 Boylston St., Boston, Mass.	1901
RIVES, WILLIAM C., M. D.	.1723 I St., Washington, D. C.	1885
RIXEY, P. M., M. D.	U. S. Navy, Washington, D. C.	1903
ROBERTS, CHARLES F., M. D.	.250 W. 57th St., New York, N. Y.	1892
ROBERTS, HUGO, M. D.	.27 Animas St., Havana, Cuba.	1904
*ROBIN, ALBERT, M. D.	.1223 Market St., Wilmington, Del.	1899
ROBINS, VERNON, M. D.	.717 Second St., Louisville, Ky.	1904
*ROBINSON, PROF. FRANKLIN C.	Brunswick, Me.	1889
ROBINSON, JOHN FRANKLIN, M. D.	Manchester, N. H.	1894
ROSS, JOHN WALTON, M. D.	Ancon, C. Z.	1902
RUIZ, LUIS E., M. D.	c Roma 2049, Mexico, Mex.	1902

* Also members of Section of Bacteriology and Chemistry.

REVISED LIST OF MEMBERS.

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*RUSSELL, H. L.....	Madison, Wis.	1899
RUSSELL, JAMES PERCY, M. D.....	Augusta, Me.	1903
RUSSELL, JULIA WALLACE, M. D.....	44 Pleasant St., Concord, N. H.	1892
RUTHERFORD, J. G., M. D.....	Ottawa, Ont.	1902
SALMON, D. E., D. V. M....	Bureau Animal Industry, Washington, D. C.	1883
SARVIN, LUTHER ROBINSON.....	Box 11, Katonah, N. Y.	1904
SCHAFFNER, FRED. LAWRENCE, M. D.....	Boissevain, Manitoba.	1902
SCHOONOVER, WARREN, M. D.....	115 East 59th St., New York, N. Y.	1895
SCHULZ, F. M., M. D.....	663 16th St., Milwaukee, Wis.	1901
SEAMAN, LOUIS L., M. D.....	247 Fifth Ave., New York, N. Y.	1901
*SEDGWICK, PROF. W. T.....	491 Boylston St., Boston, Mass.	1902
SHEA, THOMAS B., M. D.....	132 Warren St., Boston, Mass.	1900
SHEPARD, CHARLES H., M. D.....	Columbia Heights, Brooklyn, N. Y.	1892
SHERMAN, WALTER J., C. E.....	613 Nasby Bldg., Toledo, Ohio..	1904
SHERWOOD, F. E., M. D.....	Albion, N. Y.	1904
SHUTE, GEORGE PERCIVAL, S. E.....	Hotel Vendome, Columbus, Ohio.	1903
SIMON, F., M. D.....	336 Spring St., Buffalo, N. Y.	1901
SMERSH, F. M., M. D.....	Owatonna, Minn.	1899
*SMITH, ERASTUS G., PH. D.....	Beloit, Wis.	1901
SMITH, FREDERICK W., M. D.....	606 So. Salina St., Syracuse, N. Y.	1896
*SMITH, HERBERT E., M. D....	Med. Dept. Yale Univ., New Haven, Conn.	1899
SMITH, JOSEPH ROME, M. D.....	2135 Spruce St., Philadelphia, Pa.	1902
*SMITH, THEOBALD, M. D.....	Forest Hills, Boston, Mass.	1899
SMITH, WM. F., M. D.....	Orient, L. I.	1901
SMOCK, PROF. JOHN C.....	Trenton, N. J.	1899
*SNODGRAS, C. A., M. D.....	City Hospital, St. Louis, Mo.	1902
*SOPER, GEO. A., PH. D.....	29 Broadway, New York, N. Y.	1900
SOTO, ALBERTO GARDUNO, M. D.....	Juarez 14, Toluca, Mex.	1903
SPAULDING, HEMAN, M. D.....	City Hall, Chicago, Ill.	1900
SPENCER, LEONARD E., M. D.....	Wausau, Wis.	1903
STANTON, BYRON, M. D.....	931 Dayton St., Cincinnati, Ohio.	1889
*STARKEY, T. A., M. D.....	McGill Univ., Montreal, P. Q.	1902
*STENGEL, ALFRED, M. D.....	Pepper Laboratory, Philadelphia, Pa.	1899
*STERNBERG, GEO. M., M. D.....	2144 California Ave., Washington, D. C.	1874
STILES CHARLES WARDELL, PH. D.,	25th and E Sts. N. W., Washington, D. C.	1904
*STOKES, WM. R., M. D.....	Baltimore, Md.	1899
*STONE, BINGHAM H., M. D.....	Burlington, Vt.	1900
STRAUSS, NATHAN.....	Broadway and 34th St., New York, N. Y.	1903
SUITER, F. C., M. D.....	La Crosse, Wis.	1899
SUTHERLAND, QUINCY ORLIN, M. D....	73 Milwaukee St., Janesville, Wis.	1895
*SWARTS, GARDNER TABER, M. D.....	Providence, R. I.	1894
SYLVESTER, IRA W., C. E.....	Alexandria, La.	1903
SYRACUSE UNIVERSITY.....	Syracuse, N. Y.	1899
TALBOT, MARION.....	University of Chicago, Chicago, Ill.	1895
THAU, A. BLAIR, M. D.....	Santa Barbara, Cal.	1901
THOMAS, JOHN NEWTON, M. D.....	Quarantine, La.	1903

* Also members of Section of Bacteriology and Chemistry.

TOBEY, H. A., M. D.....	Toledo, Ohio.	1904
TORRALBAS, FREDERICK, M. D.....	23 Compostela St., Havana, Cuba.	1904
TOWNE, S. R., M. D.....	Omaha, Neb.	1895
TOWNSEND, JOSEPH H., M. D.....	39 College St., New Haven, Conn.	1901
TRONCOSA, MANUEL URIBE, M. D.....	Tacuba 14, Mexico, Mex.	1903
TUCKER, WILLIAM C., S. E.....	156 Fifth Ave., New York, N. Y.	1903
TURNBULL, THOMAS, M. D.....	314 Western Ave., Allegheny, Pa.	1897
TUTTLE, THOMAS D., M. D.....	Billings, Mont.	1904
UNDERWOOD, WM. LYMAN.....	Belmont, Mass.	1902
UTLEY, EDWARD R., M. D.....	Newton, Mass.	1898
VALDES, GARCIA EMILIO, M.D.....	7 Crespo St., Havana, Cuba.	1904
VALDES, ULISES, M. D.....	San Juan de Dios 267, Mexico, Mex.	1903
VALENTINE, FERD. C., M. D.....	31 W. 61st St., New York, N. Y.	1896
VENERO, PANTALEON, M. D.....	119 Industria St., Havana, Cuba.	1904
VILDOSOLA, FRANCISCO J.....	97 Compostela St., Havana, Cuba.	1904
VILLALONGA, JOSE LOPEZ, M. D.....	89 Galiano St., Havana, Cuba.	1904
VROOMAN, MORRELL, C. E.....	42 Main St., Gloversville, N. Y.	1904
WADE, JOHN W., M. D.....	318 No. 2d St., Millville, N. J.	1897
WALES, GEORGE R.....	Bellows Falls, Vt.	1903
WALCOTT, HENRY P., M. D.....	Cambridge, Mass.	1880
WARNER, FRANK, M. D.....	Columbus, Ohio.	1899
WATSON, IRVING A., M. D.....	Concord, N. H.	1881
WAY, J. HOWELL, M. D.....	Waynesville, N. C.	1904
WERTENBAKER, CHARLES P., M. D	U. S. Marine Hospital, New Orleans, La.	1902
*WESBROOK, FRANK F., M. D.....	Minneapolis, Minn.	1897
*WESTON, ROBERT SPURR.....	14 Beacon St., Boston, Mass.	1896
*WHIPPLE, GEO. C.....	220 Broadway, New York, N. Y.	1899
WHITE, ALFRED T.....	130 Water St., New York, N. Y.	1899
WHITE, WILLIAM A.....	130 Water St., New York, N. Y.	1888
WHITNEY, ELI.....	New Haven, Conn.	1900
WHYTE, WM. J., M. D.....	500 Second St., Watertown, Wis.	1904
WILBUR, CRESSY L., M. D.....	Lansing, Mich.	1894
*WILEY, H. W.....	1314 10th St., N. W., Washington, D. C.	1901
*WILLIAMS, ANNA W., M. D.....	342 71st St. W., New York, N. Y.	1904
*WILLIAMS, HERBERT U., M. D.....	24 High St., Buffalo, N. Y.	1901
WILLCOX, W. F.....	Cornell University, Ithaca, N. Y.	1899
WILSON, ERASTUS, M. D.....	108 Monte St., Havana, Cuba.	1904
*WILSON, EZRA H., M. D.....	Hoagland Laboratory, Brooklyn, N. Y.	1897
*WILSON, ROBERT, JR., M. D.....	165 Rutledge Ave., Charleston, S. C.	1901
WINGATE, U. O. B., M. D.....	204 Biddle St., Milwaukee, Wis.	1890
*WINSLOW, C.-E. A.....	Hotel Oxford, Boston, Mass.	1902
WISHARD, WILLIAM N., M. D.....	Indianapolis, Ind.	1901
WITHERELL, F. W., S. E.....	Muncie, Ind.	1904
WOOD, ALFRED VINCENT.....	177 Gloucester St., Brunswick, Ga.	1892
WOOD, MRS. C. P.....	108 Powell Ave., Evansville, Ind.	1900

* Also members of Section of Bacteriology and Chemistry.

REVISED LIST OF MEMBERS.

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WOOD, PROF. EDWARD S.....	Harvard Medical School, Boston, Mass.	1895
WOODBIDGE, S. HOMER.....	Mass. Inst. of Technology, Boston, Mass.	1895
WOODHULL, GEN. A. A., M. D., U. S. A.....	Princeton, N. J.	1874
WOODWARD, R. M., M. D., P. H., M. H. S.....	Washington, D. C.	1901
WOODWARD, WILLIAM C., M. D.....	Washington, D. C.	1896
WORCESTER FREE LIBRARY.....	Worcester, Mass.	1897
WRIGHT, FRANK W., M. D.....	48 Pearl St., New Haven, Conn.	1889
WRIGHT, JOHN W., M. D.....	Erie, Pa.	1897
WROTH, JAMES H., M. D.....	Albuquerque, N. M.	1902
WYMAN, WALTER, M. D.....	P. H. and M. H. S., Washington, D. C.	1884

Y MONTANE, FRANCISCO ETCHEGOYEN, D. V. M.	85 Amistad St., Havana, Cuba.	1904
ZEQUEIRA, JOSE VARELA, M. D.....	34 Prado St., Havana, Cuba.	1904
ZIMMERMAN, C. P.....	Newark, N. J.	1904

HONORARY MEMBERS.

Ex-President GROVER CLEVELAND.....	Princeton, N. J.	1885
J. B. RUSSELL, M. D., LL. D.....	Glasgow, Scotland.	1886
MRS. ELIZABETH THOMPSON.....	New York, N. Y.	1887
President PORFIRIO DIAZ.....	Mexico, Mex.	1892

LIFE MEMBER.

HENRY LOMB.....	Rochester, N. Y.	1884
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FOREIGN MEMBERS.

GARCIA, EDUARDO, M. D.....	Santiago de Chili, Chili.	1902
KAYE, JAMES ROBERT, M. D.....	Wakefield, Eng.	1904
MOORE, EDUARDO, M. D.....	Santiago de Chili, Chili.	1902
PRECIADO, ALFONSO, M. D.....	Panama, Panama.	1904

MEMBERS ELECTED AT BOSTON MEETING, 1905.

ADAMI, GEORGE J., M. D.....	McGill University, Montreal, Quebec.
BALDWIN, HERBERT B.....	9 Franklin St., Newark, N. J.
BARTOW, EDWARD.....	University of Illinois, Urbana, Ill.
BAYLES, HOWARD G., C. E.....	37 W. 34th St., New York, N. Y.
*BIGELOW, W. D.....	Bureau of Chemistry, Washington, D. C.
*BILLINGS, JOHN S., JR., M. D....	55th St. and 6th Ave., New York, N. Y.
BONILLO, EMILIO J., M. D.....	15 Miradores, Puebla, Mexico.
†BUNKER, GEORGE C.....	Charleston, Mass.
BUTTERWORTH, ROGER H.....	84 Dodd St., East Orange, N. J.
*†COUNCILMAN, W. T., M. D.....	Harvard Medical School, Boston, Mass.
COWAN, C. F., C. E.....	Dept. of Health, Havana, Cuba.
CROWDER, T. R., M. D.....	Pullman Building, Chicago, Ill.
*CUNNINGHAM, MOTT CESSNA.....	Marietta, Pa.
DICKINSON, DWIGHT, M. D.....	U. S. Navy, Portsmouth, N. H.
DICKINSON, GORDON K., M. D....	278 Montgomery St., Jersey City, N. J.
DIXON, SAMUEL G., M. D.....	Ardmore, Pa.
*DOLE, RICHARD BRYANT.....	1330 F St., N. W., Washington, D. C.
*DREYFUS, WM., D. Sc.....	162 95th St., New York, N. Y.
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Milwaukee: F. M. Schulz, M. D.; U. O. B. Wingate, M. D.

Watertown: Wm. J. Whyte, M. D.

Wausau: Leonard E. Spencer, M. D.

* Also members of Section of Bacteriology and Chemistry.

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REPUBLIC OF CUBA.

1905.

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(Has no District Board of Health.)

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(Territorial Board of Health.)

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IDAHO.

Idaho has no State Board of Health, nor is there any one acting in lieu of such board. A statute authorizes the Board of County Commissioners in each county to appoint a County Physician, who, together with the Board of Commissioners, constitute a board of health. This board has jurisdiction in the county only.

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(Department of Health.)

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(Insular Board of Health.)

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An Annual Sanitary Conference of the Health Officials of Connecticut is held under the auspices of the State Board of Health.

INDIANA.

There is no voluntary State Sanitary Association. There are held under the auspices of the State Board of Health two health officers' schools annually. In June the school for county and city health officers is held. In December the health officers' school for town health officers, is held.

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The State Board of Health has an annual conference with county and municipal health officers. The second annual conference was held in Topeka, June 27, 1905.

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Sanitary conventions held one or more times each year, at different towns in the State.

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(Organized 1892.)

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NEW YORK.

An annual Sanitary Conference is held each year under the auspices of the State Health Department.

OHIO.

Joint meeting of state and local boards of health held in January of each year. President and Secretary of State Board of Health, *ex-officio*, officers.

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WYOMING.

A conference of members of the State Board of Health and County Health Officers is held each year.

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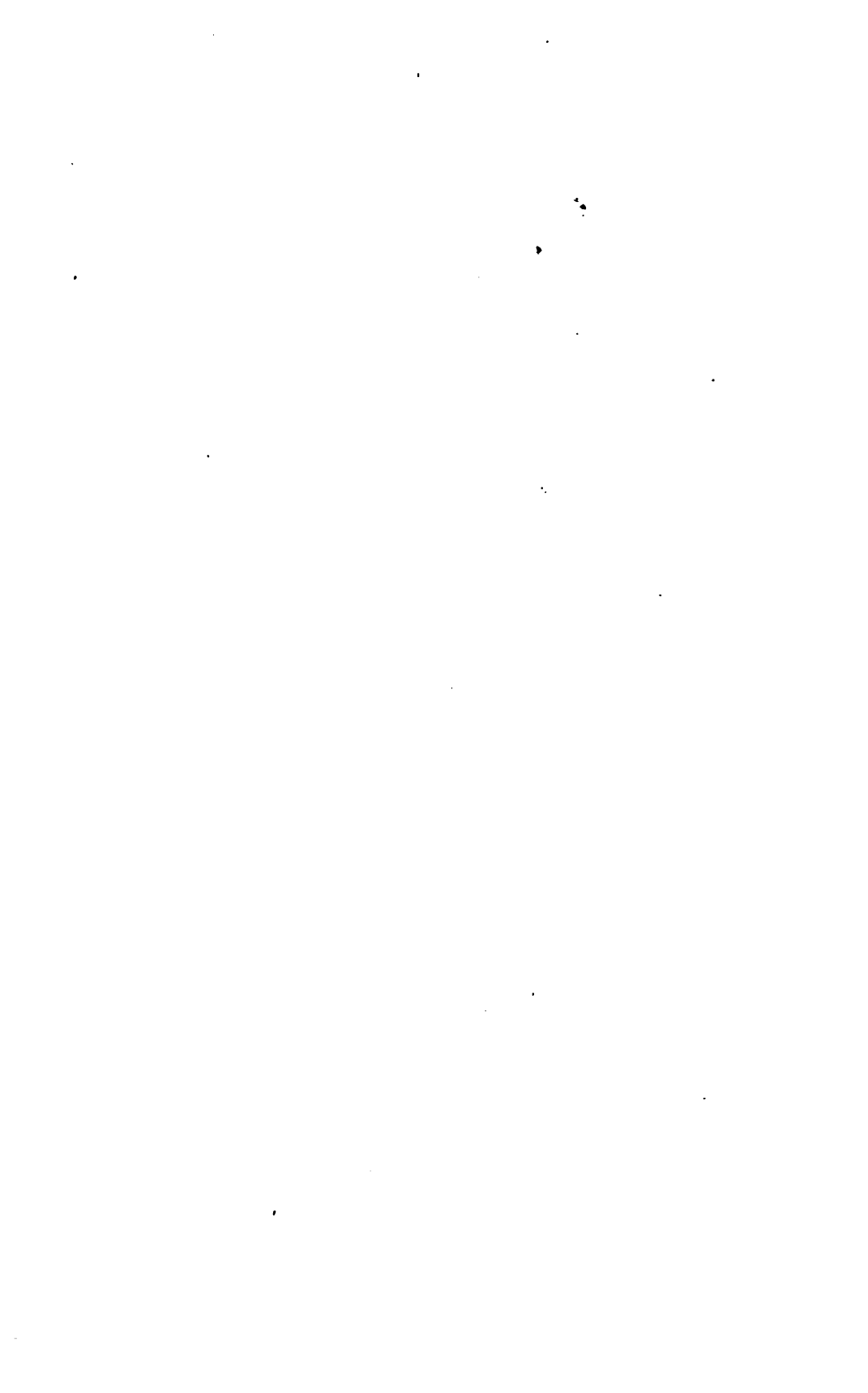
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